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A Dynamic Retention Model for Air Force Officers

Theory and Estimates

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December 1984

Rand

PROJECT AIR FORCE

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A Project AIR FORCE Report
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PREFACE

The executive and legislative branches of the government, as well as the Air Force itself, are continually proposing changes in the military nondisability retirement system, in other aspects of compensation, and in the "up-or-out" promotion system. This report describes a new dynamic retention model that will enable assessment of the effects of such changes on the voluntary retention behavior of Air Force officers, and therefore on the structure and cost of the officer force. The theory and estimated parameters of the model, comparisons between actual retention rates and those predicted by the model, and an examination of five hypothetical changes in compensation policy are presented here.

The report is intended for users of the dynamic retention model for Air Force officers and for analysts who wish to model the effects of compensation and personnel policy changes on the retention of other components of the active-duty military. However, the nontechnical reader who skips the mathematical sections will still understand the basic structure of the model and the results.

This report was prepared for the Directorate of Personnel Plans, Office of the Deputy Chief of Staff, Manpower and Personnel, Headquarters, United States Air Force, as part of the "Officer Personnel Management Study" of the Project AIR FORCE Resource Management Program.

SUMMARY

This report describes the theory and methodology for estimating the parameters of a dynamic retention model for Air Force officers. **The estimated model is used to calculate, for different compensation and personnel policies, the probability that an Air Force officer will voluntarily remain in the service.** The structure of the model depends neither on current up-or-out promotion policies nor on the rate and structure of compensation and retirement benefits, but instead requires that such policies be specified as inputs. The model can therefore be used to evaluate the retention implications of alternatives to these policies even though the alternatives may be quite different from those experienced in the past.

The dynamic retention model was designed to estimate voluntary retention rates under a broad range of compensation, retirement, and personnel policies. Included in the personnel policy changes are promotion rates, regular force integration rates, and the timing of mandatory separation or retirement (high year of tenure). These changes may be examined singly or in combination. For example, proposed retirement system changes might contain changes not only in the amounts and timing of retirement annuities but also in the timing of mandatory retirement. The compensation changes that can be examined include the year-of-service or grade structure of basic pay and aviation career incentive pay, as well as bonuses and across-the-board pay.

The model is explicitly designed for dynamic policy analysis. It can be used to examine the effects of, say, an unexpected increase in the level of military pay on retention rates immediately following the increase as well as the longer term adjustments of retention rates to the higher level of pay. Problems that require the examination of alternative policies to achieve a specific personnel force structure require the integration of the retention model with a dynamic inventory projection model.

The parameters of the model were estimated for nine distinct groups—three aeronautical rating classes (pilot, navigator, and nonrated) receiving commissions from any of three sources (Academy, ROTC, and Officer Training School). For each such group, the parameters were estimated using actual stay/leave decisions of officers, promotion rates, mandatory separation rates, compensation tables, and other inputs from fiscal years 1973 through 1977. With the estimated parameters, voluntary retention rates may be predicted for the various combinations of:

- fiscal year,
- year of expiration of the initial active-duty service commitment,
- year of commissioned service,
- component (regular, reserve),
- grade (captain, major, lieutenant colonel, colonel), and timing of promotion to that grade.

The actual stay/leave decisions of officers in the sample period are consistent with the predictions of the model. Air Force officers behaved as if they were obeying the optimal stopping rules contained in the stochastic dynamic program. Comparisons of the model's predictions with the predictions of two other models currently used in the Department of Defense—the ACOL (Annualized Cost of Leaving) and PVCOL (Present Value Cost of Leaving) models—show that the dynamic retention model eliminates several types of systematic prediction errors.

The types of predictions generated by the dynamic retention model are illustrated by the examination of five hypothetical changes to compensation levels and structure in effect from 1973 to 1977. These changes are (1) an increase in all active-duty pay elements by 5 percent in FY 1976 and FY 1977; (2) introduction of $10,000 bonuses for officers who complete certain numbers of years of service; (3) indexing of retirement annuities to the minimum of the percentage increase in the Consumer Price Index and active-duty pay; (4) an increase in flight pay by 25 percent; and (5) indexing of active-duty pay to the Consumer Price Index beginning in FY 1973. In each case the predicted retention rates of ROTC pilots and nonrated officers are compared with rates predicted in a base case. These hypothetical changes were specifically selected to demonstrate the model's properties.

In the illustrative policy simulations, the retention decisions of pilots are uniformly less sensitive to pay changes than those of nonrated officers. Similarly, the retention behavior of officers in later years of service is less sensitive than that of officers in earlier years. For example, in response to the 5 percent pay increase, in the first two years after completing the active-duty service obligation, the percentage of pilots retained increased by less than 4 percent, while the percentage of nonrated officers retained increased by more than 7 percent. Nonrated retention in the fourth and fifth years after the active-duty service obligation increased by less than 3 percent; the change in pilot retention in these years of service was negligible.

ACKNOWLEDGMENTS

Colonel Edwin Wilson (ret.) and Colonel Charles Walters (ret.) sponsored and encouraged this research while each was Chief of the Analysis Division, Directorate of Personnel Plans, Headquarters USAF. Other Air Force personnel at Headquarters USAF, the Manpower and Personnel Center, and the Human Resources Laboratory supplied important data and institutional knowledge.

Rand colleagues Frederick Finnegan and Richard Stanton played invaluable roles in understanding and cleaning of data. Richard Stanton designed a system of computer models to integrate the data, and Roy Danchick designed and coded the numerical procedures for estimating the parameters of the dynamic retention model. William Rogers, Robert Bell, and Gainford J. Hall contributed important comments and suggestions on statistical methods. Stephen Salant suggested considerable improvements in exposition. Richard Hillestad provided a useful review of an earlier draft.

CONTENTS

TABLES

I. INTRODUCTION

The dynamic retention model was designed to estimate voluntary retention rates of Air Force officers under a broad range of compensation, retirement, and personnel policies. The model describes the decisionmaking process of individuals making stay/leave decisions over time in an uncertain environment, thereby allowing predictions for policy changes that have no historical analogues. Three aspects of the model contribute to its versatility as a policy analysis tool. First, it explicitly accounts for the interactions among promotion, compensation, and retirement policies and the effects of these interactions on stay/leave decisions. Promotion opportunities and timing and high-year-of-tenure policies are inputs to the model. Researchers thus can examine changes in these policies by varying the inputs. Second, the model recognizes that officers value flexibility because they cannot be certain when they will ultimately leave the military. The model predicts that policies restricting flexibility will reduce retention rates. Third, the model accounts for persistent differences among individuals in their attachments to the military. This gives rise to a "backward-looking" aspect of retention rates in the model, that is, the retention rate at any year-of-service point depends upon the history of personnel and compensation policies preceding it. Accounting for persistent differences also allows the model to predict plausible retention responses to policy changes in cases where other models cannot. For example, the model will predict the proportion of a year group that will choose to be grandfathered under the existing retirement system rather than being switched to a new system.

The model addresses the stay/leave problem confronting officers: the choice of the optimal time to leave the military when the objective is to maximize the expected present value of pecuniary and nonpecuniary returns. This sequential decision problem of an individual with a given attachment to the military is first characterized as a stochastic dynamic program. This characterization forms the basis for the estimation and prediction procedures. The integration of sequential decision theory and statistical inference when agents are heterogeneous constitutes the methodological contribution of this report.

The outputs of the model are predictions of voluntary retention rates for male Air Force line officers.[1] These retention rates are broken down by:

- fiscal year,
- aeronautical rating (pilot, navigator, nonrated),
- source of commission (Academy, ROTC, Officer Training School/other),
- year of expiration of initial active-duty service commitment,
- year of commissioned service,
- component (regular or reserve),
- grade (captain, major, lieutenant colonel, colonel), and year of service when promoted to that grade.

The parameters of the model were estimated with data from fiscal years 1973 through 1977. The probabilities of promotion and integration into the regular force as well as estimates of military and civilian earnings were treated as exogenous variables in the stochastic dynamic

[1]A retention rate is the fraction of officers *beginning* a given year of service that *completes* that year. Calculation of voluntary retention rates excludes officers who have not completed their initial active-duty service obligations.

program. The results of these calculations were matched with individual officers' stay/leave decisions to yield maximum likelihood estimates of the parameters. A major finding of this study is that Air Force officers behaved as if they were obeying the optimal stopping rules contained in the stochastic dynamic program.

The impetus for developing the dynamic retention model was the problem of assessing the retention implications of alternative compensation and personnel policies. Resolution of this problem required a model in which current policies are inputs rather than part of the model's structure. In the dynamic retention model, changes in policies require changes only in the model's inputs. Predictions of voluntary retention rates of officers flow naturally from the structure of the model. As an example, the model can predict the voluntary retention rate of Air Force pilots who were commissioned through ROTC, are regular majors, and have been in the Air Force for eight years. These predictions can be made for changes in compensation policy, such as a change in retirement vesting rules, and for changes in personnel policies, such as altering promotion rates or maximum-tenure-in-grade rules.

II. A THEORY OF RETENTION DECISIONMAKING

The main purpose of the model is to predict retention behavior. Two recurring problems in econometric practice have made estimation of retention behavior difficult and prediction hazardous. The *optimal response problem* is primarily economic. The *selection problem* is mainly statistical.

Inattention to the first problem accounts for the dismal performance of large-scale econometric forecasting models during the 1970s and 1980s. These model builders overlooked the basic economic principle that as an individual's opportunity set is modified, so is his behavior.[1] Economists can make only conditional forecasts, *and* these conditional forecasts will be successful only if the econometric model making them is based on optimal decisionmaking by those who will be affected by postulated changes in conditions or policies.[2]

The same is true in predicting the retention response to changes in Air Force policy. Unless the forecasting model contains the officers' optimal response function for the heterogeneous mixture of officers, there is no reason to believe the predictions. In the model developed here, the optimal response functions are the sequential optimal decision rules calculated in the dynamic program weighted according to the econometric estimates of the underlying parameters.

Heterogeneity in tastes implies that officers with little taste for the military are the first to leave. The average taste for service of the remaining officers should rise as years of service increase. Therefore, retention rates should increase with years of service even if financial incentives for staying don't change. Inattention to this selection phenomenon leads to improper attribution of the causes of rising retention rates by year of service and overstatement of the responsiveness of retention decisions to changes in, for example, military income, which rises with years of service.

As a prelude to the dynamic retention model, consider the simplest stopping problem—whether to leave the military or to continue when continuation results in one last career gamble.[3] Suppose that if the officer continues he has a 50 percent chance of staying at his old grade with a salary of \$20. Moreover, suppose he expects \$50 if he leaves the military. In the case portrayed in Fig. 1, the officer can expect a payoff of \$60 if he stays ($^1/_2 \times 100 + {}^1/_2 \times 20 = \$60$). This expected payoff should be "carried back" and recorded above the chance node (denoted by an open circle), which follows the decision to continue. The officer's *only decision* is whether to continue and receive this expected payoff of \$60 or to leave and receive an expected payoff of \$50. The officer is assumed always to choose the alternative that results in the higher payoff. In this case he would choose to continue. The expected payoff (\$60) from

[1]The dynamic retention model is similar in spirit to recent work on rational expectations. This recent critique, beginning with Phelps et al. (1980) and pursued by Lucas (1976), Lucas and Sargent (1980), Sargent (1979), and Sargent and Wallace (1976) applies to *both* micro and macroeconometric policy. That is, the Lucas critique accuses econometric policy analysis of violating two principles: the first is that an economic agent's behavior responds as government policies encroach on the agent's opportunity set; the second is that economic decisionmaking takes place over time in a probabilistic environment. Current behavior is influenced both by past decisions and anticipated future decisions. When stated in this way it is clear that the Lucas attack is aimed not only at large-scale macro models, but also at much of microeconometric policy analysis conducted with static, deterministic models.

[2]Some critics of rational expectations (Sims, 1982) claim that the average citizen is not motivated sufficiently to collect and absorb the information necessary for "rational" decisionmaking. No such objection applies in our model. The agents are strongly motivated to keep close tabs on changes in policy variables and to adjust their retention behavior accordingly.

[3]Rand colleague Stephen Salant constructed the following example for us.

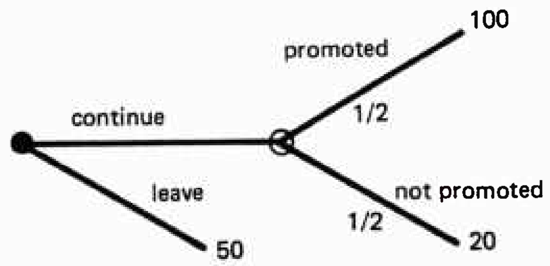

Fig. 1

this optimal decision can once again be carried back and recorded above the personal node (denoted by a filled circle) at which the retention decision is made.

The same procedure can be applied to a tree with *any finite number* of promotion stages. Consider the more complicated tree in Fig. 2. In this case the officer faces two career gambles and has the option of leaving the Air Force before the first gamble or before the second after observing how his first gamble turned out. The officer has three potential decisions to make. (To avoid clutter, we have omitted writing the payoff at each of the seven end-points of the tree.)

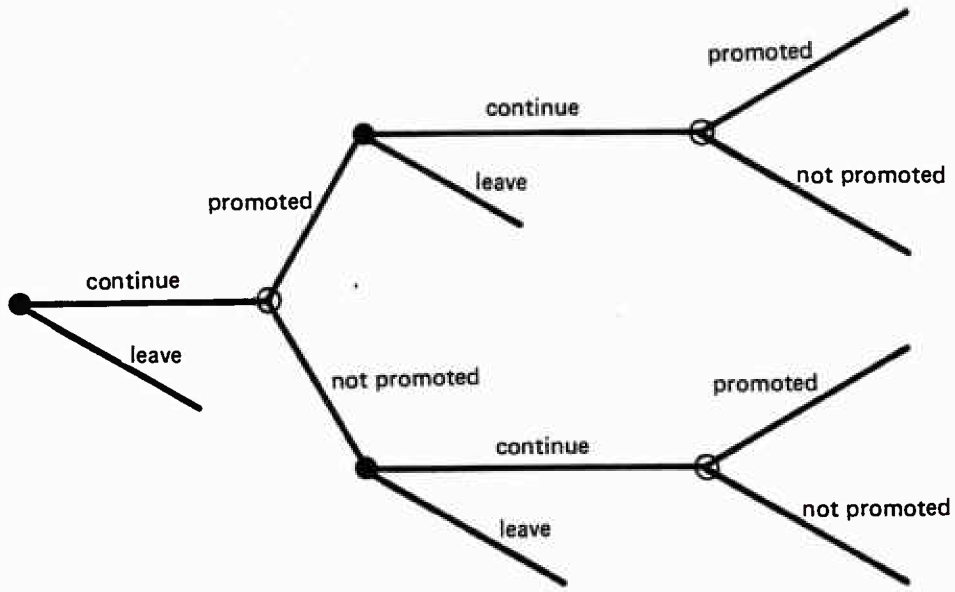

Fig. 2

To determine what behavior of the officer is optimal by applying the above principles for the simpler example, start at the end and work backward. If the officer was promoted initially and decided to continue he would face the final career gamble in the top section of the tree. The expected payoff from this gamble can be calculated and recorded above the chance node. Next, the optimal decision of whether to continue or leave given that the officer was initially promoted can be determined by a straightforward comparison of the value of leaving to the value of continuing (the expected payoff just recorded). The expected payoff from the optimal decision is recorded above the personal node where the decision is made. Repeat this entire procedure for the case where the officer *failed* to be promoted initially. The analysis of the *initial* retention decision is then straightforward because the tree in Fig. 2 has been "folded back" to the point where it is identical to the tree in Fig. 1.

The procedure of working backward, recording the expected payoff at each chance node, determining whether the decision to stay or to leave results in the higher expected payoff, and then recording the expected payoff above the personal node can be applied to a problem with *any* finite number of stages. Obviously, a computer can solve such problems more quickly than a person if they are complex. But however the solution is obtained, it predicts how an officer would *behave* over time when faced with the various situations that might arise under the specified policy regime during his career.

If the analyst could see *all* of the information available to the officer at each stage, then he could predict how *all* officers in a particular situation would behave. But in fact, considerations *unknown* to the analyst—e.g., a death in the family, the sudden onset of acrophobia—would affect the optimal sequential decisions of the officer. Two officers who appear to have had the identical career path up to some decision point may act differently because of random unobservable events.

Even this idea is easily incorporated in the decision tree. In Fig. 3 the officer once again faces two rounds of promotion gambles. But before deciding whether to face the second promotion gamble or to drop out, the officer draws a random variable, ϵ. For simplicity we assume in the figure that the random variable is drawn from a two-point distribution. If the officer leaves, he forgoes the realized ϵ; but if he continues, he receives it (ϵ may be positive or negative). Hence the particular value of ϵ (high or low) should be added only to those end-points of the tree that follow the decision to continue in the military.

To solve the problem depicted in Fig. 3, simply work backward as before. Although the solution obtained would imply, for example, that *all* officers who were initially promoted *and* who draw a low ϵ would behave in the same way, the analyst is *unable* to distinguish such officers from those with the same career history who draw a high ϵ. The computerized model assumes that each officer draws ϵ from a normal density with zero mean before each stay/leave decision. If the analyst could observe all the information pertinent to the officer's decision, the variance of the density, which is *estimated* from the data, would be near zero. Hence, the model estimated below includes this possibility as a special case but also admits the possibility that the analyst does not know some information of relevance.

There is another kind of information that the analyst cannot observe. A given officer may persistently get some psychic value (positive or negative) each year from being in the Air Force aside from his monetary compensation. Because the officer presumably knows this value, he can simply augment the payoff at each end-point of the decision tree to reflect the psychic rewards accumulated along the career path terminating at that end-point. The solution of the officer's problem could then be determined exactly as before.

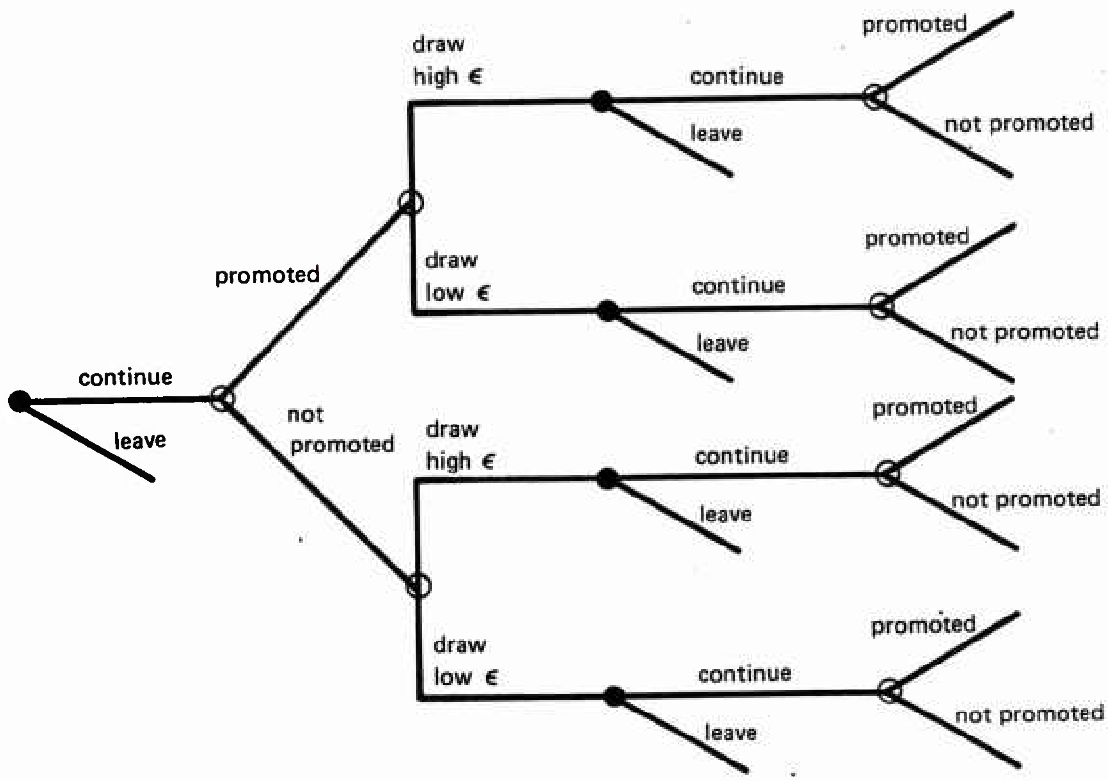

Fig. 3

The *analyst* cannot possibly know the nonmonetary value each agent places on another year in the Air Force. It is reasonable to assume that these values differ across the officers in the sample. In the complex model to follow, we assume that each officer first draws a "taste" value γ) from a given probability distribution and proceeds through the decision tree making optimal sequential decisions. Without knowledge of the ϵ sequence or the γ of each individual—the assortment of behaviors we are *likely* to sample as statistician-analysts will have to depend on the parameters of the persistent taste and transient disturbance densities. This is what permits the parameters to be estimated by maximum likelihood from the recorded retention behavior of Air Force officers in the sample.

Each officer is assumed to act as if he were solving his own dynamic program. But these officers differ in the nonpecuniary returns derived from military life. In our formulation the monetary equivalent of these nonpecuniary returns is simply added to the pecuniary returns, and the dynamic program is solved with these revised payoffs. The dynamic programming methodology resolves the optimal response problem given the officer's "taste for the military," but there will also be a distribution of optimal responses to any policy change. Explicit recognition of this is the solution to the selection problem.

The structure of decisionmaking by the Air Force and the officer presents an additional selection problem. The decisionmaking is joint in that the officer selects the Air Force and the

Air Force selects the officer. It is very much like a marriage or match in which a divorce can occur at specified points of time when either partner becomes dissatisfied. In this model the initial recruitment (marriage) is not modeled. Instead, selection first occurs when the Air Force decides which of the junior officers should be offered regular commissions. It is assumed that the odds of receiving a regular commission are higher for officers with more taste for the Air Force. Consequently, after the Air Force has offered regular commissions, the unobserved mixture of tastes of those receiving them can be expected to differ from the corresponding mixture of tastes of officers failing to receive them. Given his tastes and the Air Force's decision, each captain then decides to remain in the Air Force or leave. An assumption about the Air Force augmentation decision is that officers with strong preferences for the military are also high performance officers. The selection of high taste officers for regular commissioning reinforces the already high retention propensity of these officers because regulars have better promotion prospects than reserves. Thus the interaction between these selection processes (both being based on preferences) strengthens the bond between officers with strong preferences for the military and the Air Force. After officers make their first voluntary retention decision, the variance of γ, the random variable that measures preference for the military, will decline, and the relation between γ and performance should weaken considerably.

Measuring the influence of a policy change on retention requires understanding the nature of the selection process. In particular, it is necessary to estimate the parameters of the taste and transient disturbance distributions before drawing the appropriate inferences about policy responses.

The structure on which the dynamic retention model is built is invariant to two broad classes of policy changes. The first is changes in compensation policy including the structure of basic pay, bonuses, and the retirement system. The second is changes in personnel policy including promotion opportunities and timing, tenure provisions, and regular force integration policies. The parameters of the model, the underlying distributions of tastes and transient disturbances, do not depend on the existing values of these policies.[4] Models that depend on the existing compensation and personnel policy structures do not permit examination of changes in these structures, and models that do not attend to the selection problem predict behavior under alternative compensation and personnel structures that we find implausible.

[4]The importance of formulating dynamic economic models at the level of these "deep" parameters has been emphasized by Sargent (1979).

III. A MATHEMATICAL FORMULATION OF THE DYNAMIC RETENTION MODEL

The dynamic retention model has the following structure: Let $i = 1, 2, \ldots, 53$ denote the 53 mutually exclusive combinations of grade, promotion timing, and component (regular or reserve).[1] In the analysis, each of these combinations is a state. The grades run from captain through colonel. For each grade above captain, promotion timing is the year of service during which promotion to that grade took place. For example, $i = 10$ represents a reserve major promoted to that grade in the 14th year of service. State number 1 is reserve captain, and 2 regular captain. The civilian state is numbered 54. See Table 1.

Movement among the grades, promotion timing, and components are assumed to be generated by a first-order Markov chain with transition probabilities P_{ijt}, $i = 1, 2, \ldots, 53$; $j = 1, 2, \ldots, 54$; $t = 4, 5, \ldots, 30$, where t refers to year of service. Thus, P_{ijt} is the probability of going to state j, say regular major, in the next period, given that the state occupied this period is i, say reserve captain, and the year of service in this period is t. Demotions are extremely rare in the Air Force, so it is assumed that $P_{ijt} = 0$ whenever $j < i$. This, of course, implies that the Markov matrix P of transition probabilities is upper triangular. The upper triangular portion of the Markov matrix is also dominated by zero entries reflecting the impossibility of most one-period promotions of, for example, captain to colonel, the assumed zero probability of moving from regular to reserve component, and certain obvious restrictions on moving from one promotion timing group to another. The individual faces the Markov matrix P only if he chooses to remain in the Air Force at least one more year—i.e., the P_{ijt} are conditional on not voluntarily leaving the force. Note that $P_{i,54,t}$ is the probability of being involuntarily separated or retired. Each officer is assumed to know P and to expect that the transition matrix will not change in future years.

Military pay (basic pay plus basic allowances for quarters and subsistence)[2] depends on grade level and year of service and is denoted by m_{it} where the subscript ranges have been noted above. Furthermore, if an officer leaves the force from i upon completing t years of service, the fraction of basic pay that is collected per period is r_t.

The current formula for r_t is:

$$r_t = \begin{cases} 0 & \text{if } t < 20 \\ .025t & \text{if } 20 \le t \le 30 \\ .75 & \text{if } t \ge 30 \end{cases}$$

At each stage of the decision process an officer in state i may leave the Air Force and receive a retirement income of $r_t(m_{it} - a_{it})$ each period until his death, where a_{it} is the allowances not counted in the retirement pay calculations. Employment in the civilian labor market is assumed to proceed immediately, with $W_t(i)$ denoting the associated discounted return. Thus the expected discounted return from leaving the Air Force now and working in the civilian sector is given by:

[1] Reserve component officers in this study are on active duty. They differ from regular component officers in their tenure provisions and promotion rates. Reserve officers may become regular officers.

[2] Allowances are not taxable and basic pay is calculated in this study after federal income tax.

Table 1

STATE DEFINITIONS FOR DYNAMIC RETENTION MODEL

Grade	Component		Year of Service Promoted
	Reserve	Regular	
Captain	1	2	--
Major	3	11	7
	4	12	8
	5	13	9
	6	14	10
	7	15	11
	8	16	12
	9	17	13
	10	18	14
Lieutenant Colonel	19	30	11
	20	31	12
	21	32	13
	22	33	14
	23	34	15
	24	35	16
	25	36	17
	26	37	18
	27	38	19
	28	39	20
	29	40	21
Colonel		41	13
		42	14
		43	15
		44	16
		45	17
		46	18
		47	19
		48	20
		49	21
		50	22
		51	23
		52	24
		53	25
Civilian	54		

$$U_t(i) = r_t\,(m_{it} - a_{it}) \sum_{j=t+1}^{\infty} s_{tj}\,\beta^{j-t} + W_t(i)\ . \tag{1}$$

The probability of surviving at least until year j given survival at t is given by s_{tj}, and β is the discount factor ($\beta = 1/[1 + \rho]$ where ρ is the rate at which the individual discounts future incomes. Throughout the analysis ρ is assumed to be 10 percent).

The key to the dynamic retention model is the inclusion of nonpecuniary returns in the sequential decision process. We consider two nonpecuniary returns. The first is the monetary equivalent of the annual nonmonetary returns associated with Air Force life (net of nonmonetary returns accruing to civilians) and is denoted by the random variable γ. The cumulative distribution function of γ is given by G. Each individual has a known value of γ that remains constant over time.[3] For the kth individual this is denoted by γ_k. Of course, the presence of γ means that individual differences in preference for Air Force life will induce differences in optimal plans. The second nonpecuniary return is derived from transient shocks. Examples of transient shocks include receiving a surprisingly good or bad assignment, or having an illness in the family. The random variable ϵ is the monetary equivalent of a transient shock and has cumulative distribution function, F. The officer is assumed to know F. In general, these transient disturbances will cause a divergence between a retention policy that ignores ϵ and one that explicitly considers ϵ. A subscripted value of ϵ—ϵ_{it}—indicates a realization of ϵ known to individual i at time t. The random variables γ and ϵ are assumed to be independently distributed.

Let $V(i,\gamma_k,\epsilon_{kt})$ be the expected discounted return when the kth officer is in state i, has taste parameter γ_k, has just drawn the transient disturbance ϵ_{kt}, and follows an optimal retention policy. If after drawing ϵ_{kt}, the officer chooses to remain in the Air Force, he collects ϵ_{kt} and moves according to transition probability P_{ijt} from state i to state j in the next period. If $j < 53$—he is not involuntarily separated or retired from the Air Force—then he receives the single period compensation $\gamma_k + m_{j,t+1}$ and again chooses whether to remain or leave and receives the optimal return of $V_{t+1}(j,\gamma_k,\epsilon)$.

The value of j is unknown, but the expected value of the single period compensation plus the expected optimal return at $t + 1$ is simply:

$$\epsilon_{kt} + \beta \sum_{j=1}^{53} s_{t,t+1} P_{ijt} \left\{ \gamma_k + m_{j,t+1} + E_\epsilon \left[V_{t+1}(j,\gamma_k,\epsilon) \right] \right\}\ . \tag{2}$$

where E_ϵ denotes the expectation with respect to the transient shock, ϵ. Thus, expression (2) denotes the total return from staying in and behaving optimally thereafter (if $P_{i,54,t} = 0$). If there is a nonzero probability that the officer will be terminated even if he desires to remain, then the expected return associated with becoming a civilian,

$$P_{i,54,t}\ [\beta\, s_{t,t+1}\, \mathrm{spay}_t(i) + U_t(i)]\ ,$$

[3]Assuming that γ is constant over time is an extreme assumption. The opposite extreme is that there is no persistence in attitudes toward the Air Force—an assumption implicit in all other retention models. We do not yet know how to estimate a model with slowly changing tastes.

must be added to expression (2), where $\text{spay}_t(i)$ is any severance pay associated with the involuntary separation.[4]

The optimal decision at t, stay or leave, is obtained by choosing the maximum of (1) and (2). Thus, we have derived the following functional equation:

$$V_t(i,\gamma_k,\epsilon_{kt}) = \text{Max}\,\{(1),(2)\}\;. \tag{3}$$

For each state ($i < 54$) there is a mandatory separation or retirement year of service $T_i - P_{i,54,T_i} = 1.0$. Hence

$$V_{T_i}(i,\bullet\;,\;\bullet) = U_{T_i}(i) \quad i = 1,\ldots,53\;. \tag{4}$$

Now the expectation of the optimal return at $t+1$ is taken because the officer cannot know in advance what values future disturbances will take. This expectation is given by

$$E_\epsilon[V_{t+1}(j,\gamma_k,\epsilon)] = \int_{-\infty}^{\infty} V_{t+1}(j,\gamma_k,\epsilon)dF(\epsilon) =$$

$$\int_{-c_{t+1}(j,\gamma_k)}^{\infty} [\epsilon + A_{t+1}(j,\gamma_k)]dF(\epsilon) + U_{t+1}(j) \int_{-\infty}^{-c_{t+1}(j,\gamma_k)} dF(\epsilon) =$$

$$\int_{-c_{t+1}(j,\gamma_k)}^{\infty} \epsilon dF(\epsilon) + A_{t+1}(j,\gamma_k)[1 - F(-c_{t+1}(j,\gamma_k))] + U_{t+1}(j)F(-c_{t+1}(j,\gamma_k))\;, \tag{5}$$

where $A_{t+1}(j,\gamma_k)$ is the return from staying net of the transient disturbance and is defined by

$$A_{t+1}(j,\gamma_k) = \beta\sum_{\ell=j}^{53} s_{t+1,t+2}\, P_{j\ell,t+1}\{\gamma_k + m_{\ell,t+2} + E_\epsilon[V_{t+2}(\ell,\gamma_k,\epsilon)]\} \tag{6}$$

$$+ P_{j,54,t+1}[\beta s_{t+1,t+2}\text{spay}_{t+1}(j) + U_{t+1}(j)]\;.$$

The expected cost of leaving at $t+1$ from state j for individual k under the assumption that ϵ has mean zero is denoted by $c_{t+1}(j,\gamma_k)$ and is defined by:

$$c_{t+1}(j,\gamma_k) = A_{t+1}(j,\gamma_k) - U_{t+1}(j) \tag{7}$$

$F(-c_{t+1}(j,\gamma_k))$ is the individual's estimate of the probability of leaving the service from state j at $t+1$, given that he has reached that stage and state. This loss probability is a function of the state he occupies, of his taste for the service, γ_k, and of the distribution of transient disturbances.

Until now we have treated the Air Force as passive while the officer has been deciding whether to stay or leave. Now, assume that for officers who have not yet completed their initial-duty service obligations there is a positive correlation between γ and performance. The Air Force observes performance and offers a regular commission to an officer if his

[4]In the current system, severance pay $\text{spay}_t(i)$ is paid only to those not eligible to retire, so if r_t is positive, $\text{spay}_t(i)$ is zero.

performance is sufficiently high. As a result, the underlying mixture of unobservable tastes among officers who receive regular commissions *will be different* from the corresponding mixture of tastes among officers failing to receive commissions. In particular, the average taste of the heterogeneous group that receives regular commissions will exceed the average taste of those who fail to receive them. Thus, the retention rate of regular officers at the end of the initial active-duty service obligation will exceed that of reserve officers even in the absence of different career prospects.

The distributions of tastes for the two groups can be derived from $g(\gamma)$ as follows. Denote the exogenous probability that an officer receives a regular commission given that he has attachment γ by $Pr(Reg|\gamma)$. This exogenous probability is set by the Air Force through its policy instrument P as will be explained below. By Bayes Theorem,

$$g^*(\gamma|Reg) = \frac{Pr(Reg|\gamma) \bullet g(\gamma)}{\int_\gamma Pr(Reg|\gamma) \bullet g(\gamma)d\gamma}$$

$$g^*(\gamma|Res) = \frac{Pr(Res|\gamma) \bullet g(\gamma)}{\int_\gamma Pr(Res|\gamma) \bullet g(\gamma)d\gamma} = \frac{[1 - Pr(Reg|\gamma)] \bullet g(\gamma)}{\int_\gamma Pr(Res|\gamma) \bullet g(\gamma)d\gamma} \; . \tag{8}$$

The Air Force affects $Pr(Reg|\gamma)$ by determining what fraction (p) of eligible officers will receive regular commissions before completing their active-duty service obligations. Hence it sets

$$p = \int_\gamma Pr(Reg|\gamma) \bullet g(\gamma)d\gamma = 1 - \int_\gamma Pr(Res|\gamma)\, g(\gamma)d\gamma \; .$$

Thus, g^* is the density function for the heterogeneous taste factor conditional on whether a regular or reserve commission is held at the time of the first retention decision. (For Air Force Academy graduates $p = 1.0$ and, hence, $g^* = g$). After the members of a yeargroup have made their first voluntary retention decisions, the variance of γ will decline. Decisions by the Air Force to offer regular commissions to officers after this point are therefore assumed to be unrelated to tastes.

Now we are prepared to calculate retention rates for groups of officers. Let $S_t(i)$ denote a decision to stay at year of service t when state i is occupied. Similarly, let $L_t(i)$ denote a decision to leave at year of service t when state i is occupied. An individual's personnel history describes his entire sequence of decisions. It is a listing of what state was occupied in each year of service and what decision was taken at each point:

$$E = \{S_t(i),\ldots,S_{t+n}(j),L_{t+n+1}(j)\} \; .$$

State j is the military state occupied at the time of departure. Each unique sequence of states occupied and decisions made is an event. The first element of the event is the first voluntary retention decision and the subscript is the year of service at the time of that decision.

If $E = \{S_t(i),S_{t+1}(j)\}$, the probability of this event may be written as

$$P\{S_t(i),S_{t+1}(j)\} = \int_{-\infty}^{\infty}\left[\int_{-c_t(i,\gamma)}^{\infty} dF(\epsilon) \int_{-c_{t+1}(j,\gamma)}^{\infty} dF(\epsilon)\right] g^*(\gamma|i_1)d\gamma \ . \tag{9}$$

This is the probability that an individual in state i at year of service t will remain in the Air Force for at least two years and will be in state j the second year.[5] The probability that he remains at $t + 1$ in state j *given* that he remains at t in state i is the retention rate

$$P\{S_{t+1}(j)|S_t(i)\} = P\{S_t(i),S_{t+1}(j)\}/P\{S_t(i)\} =$$

$$\frac{\int_{-\infty}^{\infty}\left[\int_{-c_t(i,\gamma)}^{\infty} dF(\epsilon) \int_{-c_{t+1}(j,\gamma)}^{\infty} dF(\epsilon)\right] g^*(\gamma|i_1)d\gamma}{\int_{-\infty}^{\infty}\int_{-c_t(i,\gamma)}^{\infty} dF(\epsilon)g^*(\gamma|i_1)d\gamma} \ . \tag{10}$$

We call this the predicted voluntary retention rate and denote it $RET_{t+1}(j|i)$. In general, the retention rate for a given state for a given year of service will depend on the previous sequences of states occupied and the retention rates in those states.

[5]This is not to say that he foresees at t that he will occupy state j at $t + 1$. Rather, we are simply conditioning on the sequence of states occupied.

IV. DISTRIBUTIONAL ASSUMPTIONS

Tastes have been assumed to follow the extreme value distribution for maxima (see Hastings and Peacock). The density function, g, is given by

$$g(\gamma) = \frac{1}{\omega}\exp\left[-\left(\frac{\gamma-\Theta}{\omega}\right)-\exp\left(-\left(\frac{\gamma-\Theta}{\omega}\right)\right)\right] ,-\infty \le \gamma \le \infty,\ \omega > 0 \ , \tag{11}$$

and the distribution function, G , is given by

$$G(\gamma) = \exp\left[-\exp\left(-\left(\frac{\gamma-\Theta}{\omega}\right)\right)\right],\ -\infty < \gamma < \infty \ . \tag{12}$$

This extreme value distribution is skewed to the right—it has a long righthand tail. The rationale for choosing a distribution with this property is the following: Although we may expect to observe individuals in the Air Force who place almost infinite value on remaining in the service, those who place equal importance on being in the civilian labor force would never have joined the Air Force in the first place.

The parameters Θ and ω are the location and scale parameters, respectively. Θ is the mode of the distribution and it is measured in thousands of dollars per year. The mean, median, and standard deviation of the distribution are given by

$$\mu_\gamma = \Theta + 0.57721\omega \ , \tag{13}$$

$$\text{med}_\gamma = \Theta + 0.36651\omega \ , \tag{14}$$

and

$$\sigma_\gamma = 1.28255\omega \ . \tag{15}$$

We now turn to the development of g^*, the density of tastes conditional on whether a regular or reserve commission has been granted before time of the first retention decision. The probability of holding a regular commission, given that an officer has attachment γ, is assumed to have the following form:

$$Pr\{REG\,|\,\gamma\} = k\ \exp\left[-\ \frac{(1-p)^2}{p^2\,\alpha^2}\ \exp\left(-2\left(\frac{\gamma-\Theta}{\omega}\right)\right)\right], \tag{16}$$

where k is a normalizing constant and is given by

$$k = \frac{p}{\sqrt{\Pi}\,H\left(\frac{1}{2}\ \frac{p\alpha}{1-p}\right)} \ , \tag{17}$$

α is a selectivity parameter, and

$$H(x) = x \exp(x^2)\left[1 - \frac{2}{\sqrt{\Pi}} \int_0^x \exp(-t^2)dt\right] . \tag{18}$$

p is the observable policy of the Air Force and is equal to the fraction of officers who are granted regular commissions in a given year group.

There are several important properties of $Pr\{REG\,|\,\gamma\}$. First, this probability approaches one as the proportion of the year group selected for regular commissioning (p) approaches one. Furthermore, as p increases, so does the probability that an individual with any particular γ will be selected. Second, the larger the value of γ, the greater the probability of being offered a regular commission. The lower bound on $Pr\{REG\,|\,\gamma\}$ is zero and is approached as $\gamma \rightarrow -\infty$. The upper bound k (the normalizing constant) is approached as $\gamma \rightarrow +\infty$.

The parameter $\alpha(\alpha < \infty)$ is a selectivity parameter. It is estimated for only six of the nine categories, because Academy graduates—be they pilots, navigators, or nonrated—automatically receive regular commissions. The greater the value of α, the smaller the role of γ in the choice of officers for regular commissioning. Note that as $\alpha \rightarrow +\infty$, Prob(Reg$|\gamma$) approaches p, because the term in brackets of (16) goes to zero and k goes to p.[1] That is, each officer has an equal chance of being given a regular commission if selectivity is unimportant.

If the state occupied at the time of the first retention decision, i_1, is a regular state, g^* can be derived by Bayes law.

$$g^*(\gamma|reg) = \frac{k}{p\omega} \exp\left[-\frac{(1-p)^2}{p^2\alpha^2} \exp\left(-2\left(\frac{\gamma-\Theta}{\omega}\right)\right)\right] \times$$
$$\exp\left[-\left(\frac{\gamma-\Theta}{\omega}\right) - \exp\left(-\left(\frac{\gamma-\Theta}{\omega}\right)\right)\right] . \tag{19a}$$

If the state occupied at the time of the first retention decision is a reserve state, then

$$g^*(\gamma|res) = \frac{1}{(1-p)\omega}\left\{1 - k \exp\left[-\frac{(1-p)^2}{p^2\alpha^2} \exp\left(-2\left(\frac{\gamma-\Theta}{\omega}\right)\right)\right]\right\} \times$$
$$\exp\left[-\left(\frac{\gamma-\Theta}{\omega}\right) - \exp\left(-\left(\frac{\gamma-\Theta}{\omega}\right)\right)\right] . \tag{19b}$$

The distribution for the transient disturbance remains to be specified. We assume that ϵ is identically, independently, normally distributed with mean zero and standard deviation σ_ϵ.[2] We also assume that σ_ϵ is constant across sources of commission within an aeronautical rating— e.g., all pilots face the same distribution of transient disturbances. Although distributions of tastes may vary according to source of commission, nothing about transient disturbances should be related to commissioning source.[3]

Subject to the following qualifications, we must estimate four parameters for each of the nine groups (three aeronautical classifications from three sources): the location and scale parameters (Θ and ω) for the distribution of tastes, the selectivity parameter (α) for the strength of the relationship between tastes and regular commissioning before the first retention

[1] k approaches p as the argument of $H(\bullet)$ goes to infinity. Also note that the lower bound on α is $2/\Pi$.

[2] The means of ϵ and γ are not separately identifiable.

[3] Indeed, this constraint was not binding for pilots and for nonrated officers and had only a mild effect on the navigator likelihood values.

decision, and the standard deviation of the transient disturbances (σ_ϵ) . As discussed previously, we do not actually need to estimate the selectivity parameter for the Academy graduates. Moreover, we assume that σ_ϵ is the same across sources for each aeronautical classification. Hence, we estimate a total of 27 parameters.

V. THE DATA

CONSTRUCTION OF THE HISTORICAL EVENTS

An event is a unique combination of the year of service during which the individual is first eligible to leave the Air Force, the fiscal year in which he is first eligible to leave, his aeronautical rating and source of commission, the last observed voluntary retention decision, and the sequence of states he occupied. A typical event for a pilot who was commissioned through ROTC might begin in FY 1974 in the seventh year of service. The final observed decision might be "stay" with the sequence of states occupied being two years of reserve captain and two years of regular captain. Another typical event would contain the same aeronautical rating, source of commission, fiscal year, and year of service, but the final observed decision might be "leave" immediately while a reserve captain. These two events are summarized below.

1974 PIL ROTC 7YOS STAY	1	1	2	2	XX
1974 PIL ROTC 7YOS LEAVE	1				YY

The number of individuals with the same history are indicated as XX or YY. No individual is represented by more than one event. The fiscal years included in the database used to estimate the dynamic retention model were 1973 through 1977. Thus, there are events beginning in each of those fiscal years in our database. Because there are five years in the database, the longest sequence of states occupied that we can observe is five, and this sequence must begin in 1973. Events beginning in 1977 have only one observable state occupied and retention decision.

Events were constructed for all line officers with less than 24 months of prior enlisted service who were first eligible to separate voluntarily no earlier than FY 1973 and no later than FY 1977. Table 2 contains the counts of officers in the nine aeronautical rating/source of commission groups and the number of events for each group for the five year sample period. Because all Academy graduates in the sample hold regular commissions, there are fewer events for these officers. A complete listing of the events used in estimating the parameters of the dynamic retention model may be found in the appendix.

The source of data for constructing the events was the Air Force Uniform Officer Records (UOR) File maintained by the Air Force Manpower and Personnel Center at Randolph Air Force Base, Texas. The UOR database contains two major types of data: active and loss. The active database contains a record for each officer who is either currently on active duty or projected to be on active duty in the Air Force. The UOR loss data contain the records deleted from the active file for all officers who have been lost from the Air Force for whatever reason. Each end-of-fiscal year file contains approximately 100,000 active officers and 12,000 losses.

The files contain identifying information permitting the construction of longitudinal files on individuals.[1] The file also contains the individuals' current (temporary) grade, Active Duty Service Commitment Date (ADSCD), Total Active Federal Commissioned Service Date (TAFCSD), Date of Separation (DOS), Separation Program Designator (SPD), component

[1]The Uniform Officer Records are privacy protected (Privacy Act of 1974). Information from these files used in this research and presented in this report has been structured so that it is impossible to identify individuals.

Table 2

SAMPLE SIZES

Rating and Source of Commission	Number of Officers	Number of Events
Pilots		
Academy	1,695	88
ROTC	5,668	171
OTS/other	6,886	166
Navigators		
Academy	216	38
ROTC	1,264	129
OTS/other	2,236	136
Nonrated		
Academy	1,062	41
ROTC	10,608	115
OTS/other	5,141	102

(regular or reserve), effective date of rank and promotion board, source of commission, and other variables.

The officer's year of service in a given fiscal year is calculated by subtracting the TAFCSD from the date on the last day of the fiscal year and adding one. For example, in fiscal year 1975, an individual with a TAFCSD of 4/70 (April 1970) is in his sixth year of service—6/75 − 4/70 + 1 = 6 years.

Each individual was classified as either a pilot, a navigator, or a nonrated officer. An officer rated as a pilot or a navigator was considered to be one still even if suspended from flying status for health or other reasons.[2] His source of commission was either Academy, ROTC, or Officer Training School (OTS)/other.

Denote the year of service in which the officer was first eligible to separate voluntarily as EOB (for end of obligation). EOB was set at the fifth year of service for reserve nonrated officers and the sixth year of service for regular nonrated officers. For a pilot or a navigator, in the absence of a valid ADSCD it was assumed that the officer was first eligible to leave in the sixth year of service. An exception to this was for pilots from the Academy. The default value for EOB was set at the seventh year of service based on the analysis of those Academy pilots with valid ADSCDs. For these pilots or navigators, EOB was set to the year of service in which the commitment expired unless that year of service was 24 or more months greater than the default value of EOB.[3] However, if the officer completed his active-duty service

[2]This differs from the Rated Distribution and Training Management (RDTM) definitions used at the Manpower and Personnel Center. However, the number of pilots and navigators suspended from flying status is not large and the retention rates of the groups with and without suspended flyers are hardly different.

[3]It is possible for an officer to engage periodically in actions that engender additional time-in-service commitments. Typically, only an officer who has made a conscious decision to remain in the service would do so. However, because of the pattern of his ADSCDs, were we to use the rule that an officer can make a voluntary retention decision only if he has no current active-duty service commitment, we might show the officer as never making a decision. However, rated officers often accrue additional service commitments during their initial active-duty service obligation years because of, say, special training. Although the officer may freely enter into this additional obligation, we assume that it does not constitute a voluntary retention decision because it occurs so early in his career.

commitment upon completing, say, six years and eleven months of service and by the end of the fiscal year he had completed seven years of service (or would have if he had stayed), then the officer was considered to be first eligible to separate voluntarily in his eighth year of service.

There were various programs known as "early out" programs in effect during the 1970s. Officers who voluntarily separated from the Air Force under these programs fell into one of two categories. First, there were those who left after having completed the default EOBs described above, but not having completed some other active-duty service commitment. These officers were labeled as voluntary losses in the actual fiscal year and year of service during which they left. Second were those who left before reaching their default EOB year of service. This second group of officers, had they been required to remain until reaching their EOB year of service, are all assumed to have left at that time as well. Thus, the fiscal year and year of service of their separations from the Air Force were adjusted to show voluntary losses at EOB.[4]

Only a voluntary separation decision is recorded as LEAVE in an event. The state occupied at the time of an officer's involuntary separation due to promotion failure, court-martial, disability, or other reason is not recorded in an event although the states he occupied in earlier years are recorded. For example, suppose that a reserve ROTC pilot whose EOB was his eighth year of service in 1973 was involuntarily separated in 1977. The event for this individual would reflect four voluntary retention decisions,

1973 PIL ROTC 8YOS STAY 1 1 1 1 1

The fourth "1" in the state sequence represents a stay decision in the eleventh year of service in 1976.

Some reserve officers who were offered regular commissions turned them down. For the purposes of this analysis, such an officer was assumed to hold a regular commission beginning in the year in which he turned it down.[5]

PROMOTION PROBABILITIES

Probabilities of being promoted from captain to major, major to lieutenant colonel, and lieutenant colonel to colonel were calculated for each combination aeronautical rating and source of commission combination. Source of commission was broken down by Academy and non-Academy for this purpose. Within each non-Academy group, probabilities were further broken down by component (regular, reserve). For all aero rating/source of commission groups, promotion selection rates vary systematically with promotion eligibility, which is determined by time-in-grade criteria. They also vary by year of service given promotion eligibility. Thus, promotion probabilities are distributed according to these criteria as well.

Applying the eligibility criteria for each promotion selection board,[6] the number of promotion eligibles and selectees for each promotion board from 1972 through 1977 were drawn

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[4]Not adjusting their separation dates in this way would cause biases in our results unless we could also identify those who were eligible to leave early but chose not to.

[5]Were we not to make this correction, the effect of pay changes and promotion rate changes on captain retention rates would be biased upward because these officers almost always voluntarily separate, and their military income prospects would be understated. A more complete methodology would model the officer's decision whether or not to accept a regular commission.

[6]The criteria for eligibility for promotion selection were provided to us by the Officer Promotions and Appointments Branch of the Air Force Manpower and Personnel Center.

from the Uniform Officer Records. The eligibles and selectees were grouped as described above. For each grade there were ranges of years in which the promotion timing and probabilities were meant to be stable by Air Force policy. Over each of these ranges, promotion eligibles and selectees were summed within each group and then the selectees were divided by the eligibles to obtain data-based estimates of promotion probabilities by these cells.[7]

AUGMENTATION PROBABILITIES

Probabilities of being offered a regular commission vary by year of service, aeronautical rating, grade, and fiscal year. The Officer Promotion and Appointments Branch of the Air Force Manpower and Personnel Center and the Policy Division of the Directorate of Personnel Plans, Headquarters, USAF, supplied us with eligibles, selectees, and augmentation selection rates. Data from the Uniform Officer Records were used to stratify the augmentation rates by ROTC and OTS/other for pre-end-of-obligation augmentation rates for pilots.

SURVIVAL PROBABILITIES

The probabilities of living to ages 26 through 100 were obtained from a 1976 table of probabilities and life expectancies by the Office of the Assistant Secretary of Defense (Manpower and Reserve Affairs) Actuary. The survival probabilities are for non-disabled officers.

FEDERAL INCOME TAX RATES

Federal income tax rates by income class were calculated from Statistics of Income 1973: Individual Income Tax Returns, Department of the Treasury, Internal Revenue Service. Raw data were provided by Table 1.2—Adjusted Gross Income, Total Deductions, Exemptions, and Tax Items by Size of Adjusted Gross Income by Marital Status. Column 20 (total income tax) was divided by column 12 (adjusted gross income less deficit) for joint returns of husbands and wives to obtain the tax rates by income class.

MILITARY PAY AND ALLOWANCES

Basic pay, basic allowances for quarters and subsistence, and flight pay were obtained from the Uniformed Services Almanac for each fiscal year from 1973 through 1981.

Basic pay and flight pay are subject to federal income tax, whereas the basic allowances are not. Annual after-tax military earnings were calculated by taxing the sum of basic pay and flight pay (if applicable) and then adding basic allowances for quarters and subsistence. The "with dependents" rate was used for the basic allowance for quarters. After-tax military earnings vary by aeronautical rating, grade, year of service, and fiscal year.

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[7]Promotion probabilities do not fluctuate markedly from year to year unless by policy. The policy parameter is termed the promotion opportunity. The promotion opportunity to a grade is approximately the proportion of those in the next lower grade who remain in the Air Force to compete for promotion that ultimately will be promoted. The promotion opportunity to major was 90 percent from 1969 to 1974, 80 percent from 1975 to 1978, and 90 percent in 1979. The promotion opportunities to lieutenant colonel and colonel were respectively 70 percent and 50 percent through 1978.

CIVILIAN EARNINGS

Estimates of civilian earnings were derived from the Current Population Survey (CPS), March of each year (machine readable data file), conducted by the Bureau of the Census for the Bureau of Labor Statistics.

The first step in calculating civilian earnings was to construct average wage earnings by age for Caucasian males between the ages of 26 and 65 from the CPS files. Earnings were calculated only for those who had at least 17 years of education, were employed full time, worked at least 48 weeks during the survey year, and were professional, technical, or kindred workers, or managers or administrators, excluding such obviously noncorresponding occupations as physicians and dentists.

The raw age-earnings data were smoothed by fitting least squares curves (quadratic or cubic depending on the significance of the coefficient of the cubed term) to them. After-tax age-earnings profiles were calculated by netting out federal income taxes from the fitted earnings values.

The CPS earnings data are for each calendar year but the retention decisions are by fiscal year. Until 1977 fiscal years ran from July through June. Therefore, after adjusting for inflation, two calendar years' values of the estimated after-tax civilian earnings were averaged to obtain each fiscal year's values. (The averaging was done in the computer program which evaluates the dynamic programs.)

It was also assumed that during the early years of an Air Force officer's career, each year spent in the military is not valued as highly in the civilian labor market as a year spent in the civilian labor market. Because of the leadership and management responsibilities of officers in the "teen" years of service, it was assumed that officers completing 20 years of service have recovered their lost civilian earnings power.

If w_j is the average earnings of individuals in the civilian sector who are $22 + j$ years old, then let the expected earnings at $22 + j$ years of an Air Force officer who leaves the service at year of service t be ${}_t w_j$. These earnings are given by

$${}_t w_j = w_{j-t+i} \ .$$

That is, the officer suffered the loss of the equivalent of $t - i$ years of civilian work experience. If i is not integer-valued, then ${}_t w_j$ is given by

$${}_t w_j = (1 - y) w_{j-t+[i]} + y w_{j-t+[i]+1} \ ,$$

where $[i]$ means the greatest integer less than i. The variables i and y are calculated as follows:

$$i = 4 + (t - 4) \ell^{0.06(t-20)} \ ,$$

$$y = i - [i] \ .$$

Note that $i = 4$ when $t = 4$ and $i = 20$ when $t = 20$. For values of t between 4 and 20, i is less than t.

Civilian earnings prospects for pilots were calculated as weighted averages of airline pilot earnings and the civilian earnings described above. The weights in each year were determined by the size of the military pilot cohort and by airline hiring rates.[8]

[8]This is clearly an ad hoc approach to a problem of occupational choice that was beyond the scope of this study. An improved approach might be to estimate a "taste for flying" distribution among pilots in addition to the taste for

An experience-earnings profile for civilian airline pilots for 1976 was obtained from Kleinman and Zuhoski (1980) and average earnings of airline pilots for each year from 1973 to 1977 from Jehn (1979). The profile was adjusted for each year by multiplying earnings at each experience level by the ratio of average earnings in that year to those in 1976.[9] Estimated federal income taxes were then subtracted to obtain the annual after-tax airline pilot earnings by experience level.

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service. Then individuals who dislike flying would be less influenced to leave the Air Force by changes in airline hiring prospects than those who like flying.

[9]In addition to changes in the level of the age-earnings profile, changes in the experience composition of the airline pilot force will change average earnings. We could not adjust average earnings to control for compositional changes.

VI. THE ESTIMATED PARAMETERS OF THE DYNAMIC RETENTION MODEL

The parameters of the dynamic retention model for each of the nine aeronautical rating/source of commission groups were estimated by maximum likelihood. The contribution to the likelihood function of an individual who leaves at his first opportunity is

$$\int_{-\infty}^{\infty} \int_{-\infty}^{-c_t(i,\gamma)} dF(\epsilon) g^*(\gamma | i_1) d\gamma$$

and the contribution for the individual who remains for the five years of the sample period is

$$\int_{-\infty}^{\infty} \left[\int_{-c_t(i,\gamma)}^{\infty} dF(\epsilon) \ldots \int_{c_{t+4}(j,\gamma)}^{\infty} dF(\epsilon) \right] g^*(\gamma | i_1) d\gamma \ .$$

(We have suppressed fiscal year subscripting for ease of exposition.)[1]

Because $c_t(i,\gamma)$ is calculated from the stochastic dynamic program, it cannot be calculated without knowing the value of σ_ϵ, the standard deviation of the transient disturbance. Thus, the estimation was iterative. First, the stochastic dynamic program was evaluated for a trial value of σ_ϵ and then the remaining parameters were estimated by maximizing the likelihood function conditional on the value of σ_ϵ. Different values of σ_ϵ were evaluated until the maximum of the conditional likelihood values was reached.[2] We assumed that σ_ϵ varies only among aeronautical ratings and not among sources of commission within the same aeronautical rating.

Table 3 contains the parameter estimates for the nine groups. Recall that in our sample all Academy graduates hold regular commissions; thus, there is no selectivity parameter α to estimate.

DISCUSSION OF THE ESTIMATES

Three features of the estimated parameters are readily apparent. First the dispersion of tastes and transient disturbances seem, with two obvious exceptions, to be very large considering that they are in terms of thousands of dollars annually. Second, within each aeronautical rating, the dispersion of tastes among Academy graduates is lower than among ROTC and OTS graduates. Finally, the dispersion of tastes among pilots is greater than among the other two groups.

We do not have an intuitively pleasing explanation for the magnitudes of the dispersions of the transient disturbances and persistent factors. However, the following may be useful in

[1]The reader will also note that the probability is conditional on living from t through $t + 4$. The survival probabilities do not depend on the parameters of the model and the age-specific survival probabilities are assumed to be constant over the calendar time spanned by the data. Thus, factoring out the survival probabilities does not affect the parameter estimates.

[2]This estimation procedure did not lend itself to inexpensive estimates of the asymptotic standard errors of the parameters of the model.

Table 3

PARAMETER ESTIMATES OF DYNAMIC RETENTION MODEL
(Measured in thousands of dollars)

Rating and Source of Commission	θ	ω	α	σ_ε
Pilots				
Academy	-2.636	22.759		14.0
ROTC	3.888	67.111	1.873	14.0
OTS/other	-0.963	61.157	2.671	14.0
Navigators				
Academy	-8.442	1.801		11.0
ROTC	-0.856	39.893	1.827	11.0
OTS/other	-4.119	39.182	1.754	11.0
Nonrated				
Academy	-5.704	1.500		17.5
ROTC	-25.866	30.734	3.326	17.5
OTS/other	-26.621	30.405	3.072	17.5

understanding the parameter estimates. In searching for the unconditional maximum likelihood estimate of σ_ϵ, we found that, for ROTC and OTS officers, the conditional maximum likelihood estimate of the dispersion parameter for the persistent factor positively varied with the trial value of σ_ϵ. Thus, exclusion of one of these parameters from the model would drive down the value of the other parameter. We also found that exclusion of α, the selectivity parameter, decreased the unconditional maximum likelihood values of the dispersion parameters of both transient and persistent factors.

That the dispersion of tastes and other persistent factors among Academy graduates is less than among other groups is not surprising. The Academy graduates are inherently a homogeneous group. Each individual indicated a fairly strong interest in the military by applying for admission to the Academy, and each shared the experience of living in a military environment for four years and being identified as a member of a select group. Further homogenizing the Academy graduates is that roughly 35 to 40 percent of the entering freshman class do not graduate from the Academy. In contrast, ROTC and OTS graduates are drawn from a broad cross section of colleges and universities.[3]

The dispersion of tastes among pilots may be so much larger than among the other ratings because of an additional component of variance in tastes not present in the other ratings. That is, in addition to tastes for the Air Force as a way of life, pilots may also vary in their preferences for flying. However, opportunities to stay on flying duty decline as officers become lieutenant colonels and colonels. If there is this additional component of tastes, its importance should decline in the later years of service. Although we do not present these predictions here, our predictions of the retention rates of pilots who are eligible for retirement are consistently

[3]A bachelor's degree is a prerequisite for becoming an officer in the Air Force.

above the actual rates. The retention rates of nonrated officers who are eligible for retirement are not overpredicted. (We have not yet examined navigators.)

GOODNESS OF FIT

We now present a method for testing the goodness of fit of the dynamic retention model. The procedure is a simple version of the standard test.[4]

In the dynamic retention model the event of interest is leaving the Air Force. There are many cells from which a departure can occur. Associated with each such cell is a career path denoted by the vector $\underset{\sim}{i}_{t-1} = (i_1, i_2, \ldots, i_{t-1})$. For each $t \leq T - 1$ (the time horizon is T), the probability of leaving after visiting states $i_1, i_2, \ldots, i_t$ is specified by the dynamic retention model to be

$$P_{\underset{\sim}{i}_t} = RET(i_t \mid \underset{\sim}{i}_{t-1})$$

where $RET(i_t \mid \underset{\sim}{i}_{t-1})$ is the predicted probability of leaving from the state occupied in the tth year of service conditional on having experienced career path (event) $\underset{\sim}{i}_{t-1}$.

The χ^2 statistic associated with the $\underset{\sim}{i}_r$ cell is given by

$$\chi^2_{\underset{\sim}{i}_r} = \frac{(x_{\underset{\sim}{i}_r} - n_{\underset{\sim}{i}_r} p_{\underset{\sim}{i}_r})^2}{n_{\underset{\sim}{i}_r} p_{\underset{\sim}{i}_r} q_{\underset{\sim}{i}_r}} ,$$

where $x_{\underset{\sim}{i}_r}$ is the actual number of stay decisions in the cell and n is the number of officers in this cell.

Summing over all cells gives

$$\chi^2 = \sum_r \sum_{\underset{\sim}{i}_r} \frac{(x_{\underset{\sim}{i}_r} - n_{\underset{\sim}{i}_r} p_{\underset{\sim}{i}_r})^2}{n_{\underset{\sim}{i}_r} p_{\underset{\sim}{i}_r} q_{\underset{\sim}{i}_r}} ,$$

which has the χ^2 distribution with degrees of freedom equal to the total number of cells less the number of parameters estimated. A small value for the test statistic means that the model fits the data well.

Table 4 presents the χ^2 statistic and associated degrees of freedom for each of the nine aeronautical rating/source of commission combinations. As is commonly true of the χ^2 statistics with very large sample sizes (the $n_{\underset{\sim}{i}}$), the test statistics are almost invariably larger than their degrees of freedom and most are significant at conventional levels. Statistically significant errors may not be important errors, however, and we show in Sec. VII that the predictions generally fit the data quite well.

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[4]For complete treatments see Cramer (1946), and Hoel, Port, and Stone (1971).

Table 4

χ^2 AND DEGREES OF FREEDOM FOR THE DYNAMIC RETENTION MODEL

Rating and Source of Commission	χ^2	d.f.
Pilots		
Academy	178	74
ROTC	422	132
OTS/other	1132	126
Navigators		
Academy	21	36
ROTC	124	104
OTS/other	378	122
Nonrated		
Academy	32	24
ROTC	1041	86
OTS/other	682	77

VII. HISTORICAL AND PREDICTED RETENTION RATES

In this section we present tables of actual and predicted retention. The database for this study encompassed fiscal years 1973 through 1977; hence, these are the years over which the comparisons run.

The complete retention pattern for a given year group is predicted with only the four parameters for that rating and source-of-commission group and the costs of leaving from the dynamic program. There is no separate equation for each year-of-service nor are there separate equations for regulars and reserves. Thus, the model should not be judged solely on the basis of errors in specific year of service retention rates. Rather, an informal criterion for goodness of fit should be the amount of discrepancy between the actual retention patterns and the predicted patterns.

A key element of the dynamic retention model is the time at which the individual is first eligible to leave the Air Force voluntarily. Although most members of a year group may first be eligible to separate voluntarily in, say, the sixth year of service, some will not be eligible until the seventh or eighth year. Therefore, Table 5, comparing actual and predicted retention, combines officers not according to year of service but according to how many voluntary retention decisions they have made. For example, the EOB retention rate in FY 1973 is the weighted average of the voluntary retention rates of those in each year of service who were making their first voluntary retention decision in that fiscal year. Thus, the table follows end-of-obligation year groups. Under the heading FISCAL YEAR = 1975, for example, are retention rates for FY 1975 (EOB), FY 1976 (EOB+1), and FY 1977 (EOB+2). The columns of the table are the actual and predicted numbers of stay decisions, the number of officers at risk, and the actual and predicted retention rates.

Large systematic prediction errors occur only in the OTS pilot retention rates and those in the EOB cells. OTS pilot EOB retention rates were much lower than the corresponding ROTC pilot rates, yet our best parameter estimates for these two groups were roughly the same. Thus, our predictions for OTS are similar to our predictions for ROTC even though the actual rates differ. Because we did not find similar differences between ROTC and OTS navigators and nonrated officers, the differences in behavior should not be attributed to differences in the populations entering ROTC and OTS. Although we have not been able to identify the source of the retention rate differences and, hence, the source of the prediction errors, it is encouraging that the magnitude of the errors declines in the later fiscal years.

With the exception noted above, the match between predicted and actual is close. The tendency for actual retention rates to rise as years of service increase is predicted by the dynamic retention model. The dynamic retention model also captures the difference between regular and reserve retention rates. In general, the difference in these retention rates is greatest at EOB and declines in later years of service; this is what the retention model predicts.

Table 5

ACTUAL AND PREDICTED YEARGROUP RETENTION FOR THE DYNAMIC RETENTION MODEL

Each yeargroup in this table consists of those who reached the end of their active-duty service obligation (EOB) during the indicated fiscal year and had common sources of commission, aeronautical rating, and component.

Source=Academy Rating=Pilot Component=Regular					
Fiscal Year	Stays	Stays-D[a]	Inventory	Rate	Rate-D[a]
1973 EOB	235	225	292	0.805	0.771
1974 EOB + 1	222	214	230	0.965	0.930
1975 EOB + 2	213	217	218	0.977	0.996
1976 EOB + 3	208	210	211	0.986	0.995
1977 EOB + 4	202	206	207	0.976	0.993
1974 EOB	254	252	339	0.749	0.745
1975 EOB + 1	241	243	249	0.968	0.978
1976 EOB + 2	230	229	231	0.996	0.991
1977 EOB + 3	225	226	230	0.978	0.985
1975 EOB	303	332	400	0.757	0.830
1976 EOB + 1	292	288	300	0.973	0.960
1977 EOB + 2	280	277	289	0.969	0.958
1976 EOB	215	201	244	0.881	0.823
1977 EOB + 1	195	188	204	0.956	0.923
1977 EOB	333	322	420	0.793	0.767

Table 5—continued

Source=Academy Rating=Navigator Component=Regular					
Fiscal Year	Stays	Stays-D[a]	Inventory	Rate	Rate-D[a]
1973 EOB	43	42	48	0.896	0.878
1974 EOB + 1	36	35	40	0.900	0.886
1975 EOB + 2	33	33	34	0.971	0.962
1976 EOB + 3	31	30	31	1.000	0.982
1977 EOB + 4	31	31	31	1.000	0.985
1974 EOB	35	35	44	0.795	0.787
1975 EOB + 1	32	31	34	0.941	0.919
1976 EOB + 2	30	30	31	0.968	0.955
1977 EOB + 3	28	29	30	0.933	0.977
1975 EOB	14	14	16	0.875	0.879
1976 EOB + 1	13	13	14	0.929	0.931
1977 EOB + 2	11	11	11	1.000	0.964
1976 EOB	47	47	55	0.855	0.861
1977 EOB + 1	40	41	45	0.889	0.914
1977 EOB	48	46	53	0.906	0.863

Source=Academy Rating=Nonrated Component=Regular					
1973 EOB	159	166	197	0.807	0.844
1974 EOB + 1	118	122	144	0.819	0.845
1975 EOB + 2	111	106	117	0.949	0.906
1976 EOB + 3	96	93	99	0.970	0.938
1977 EOB + 4	90	93	96	0.938	0.967
1974 EOB	144	143	180	0.800	0.792
1975 EOB + 1	126	121	139	0.906	0.867
1976 EOB + 2	114	114	125	0.912	0.910
1977 EOB + 3	94	99	105	0.895	0.945
1975 EOB	187	184	224	0.835	0.820
1976 EOB + 1	157	157	180	0.872	0.870
1977 EOB + 2	142	142	156	0.910	0.912
1976 EOB	188	178	216	0.870	0.824
1977 EOB + 1	150	157	180	0.833	0.874
1977 EOB	212	202	244	0.869	0.828

Table 5—continued

Fiscal Year	Stays	Stays-D[a]	Inventory	Rate	Rate-D[a]
Source=ROTC Rating=Pilot Component=Reserve					
1973 EOB	215	279	541	0.397	0.517
1974 EOB + 1	184	183	207	0.889	0.884
1975 EOB + 2	159	171	176	0.903	0.969
1976 EOB + 3	146	150	153	0.954	0.978
1977 EOB + 4	126	127	130	0.969	0.980
1974 EOB	277	335	665	0.417	0.504
1975 EOB + 1	227	220	240	0.946	0.915
1976 EOB + 2	210	206	220	0.955	0.938
1977 EOB + 3	187	187	197	0.949	0.949
1975 EOB	295	305	543	0.543	0.562
1976 EOB + 1	252	231	269	0.937	0.860
1977 EOB + 2	221	207	234	0.944	0.886
1976 EOB	148	136	245	0.604	0.556
1977 EOB + 1	119	112	136	0.875	0.826
1977 EOB	429	445	847	0.506	0.525
Component=Regular					
1973 EOB	667	598	813	0.820	0.736
1974 EOB + 1	638	614	668	0.955	0.919
1975 EOB + 2	617	623	633	0.975	0.985
1976 EOB + 3	606	610	617	0.982	0.989
1977 EOB + 4	588	602	610	0.964	0.987
1974 EOB	552	555	695	0.794	0.799
1975 EOB + 1	553	544	565	0.979	0.962
1976 EOB + 2	542	537	552	0.982	0.973
1977 EOB + 3	536	535	551	0.973	0.971
1975 EOB	433	447	498	0.869	0.897
1976 EOB + 1	432	418	443	0.975	0.943
1977 EOB + 2	416	414	437	0.952	0.946
1976 EOB	248	253	282	0.879	0.897
1977 EOB + 1	243	231	250	0.972	0.926
1977 EOB	465	487	539	0.863	0.904

Table 5—continued

Fiscal Year	Stays	Stays-D[a]	Inventory	Rate	Rate-D[a]
Source=ROTC Rating=Navigator Component=Reserve					
1973 EOB	81	85	143	0.566	0.596
1974 EOB + 1	65	69	78	0.833	0.885
1975 EOB + 2	60	58	61	0.984	0.952
1976 EOB + 3	53	52	54	0.981	0.968
1977 EOB + 4	41	41	42	0.976	0.977
1974 EOB	83	74	131	0.634	0.561
1975 EOB + 1	71	69	75	0.947	0.917
1976 EOB + 2	65	66	70	0.929	0.948
1977 EOB + 3	32	33	34	0.941	0.959
1975 EOB	63	67	116	0.543	0.579
1976 EOB + 1	52	49	54	0.963	0.905
1977 EOB + 2	31	31	33	0.939	0.937
1976 EOB	42	42	71	0.592	0.588
1977 EOB + 1	28	32	35	0.800	0.913
1977 EOB	97	102	171	0.567	0.596
Component=Regular					
1973 EOB	149	151	180	0.828	0.837
1974 EOB + 1	141	138	148	0.953	0.931
1975 EOB + 2	139	139	142	0.979	0.979
1976 EOB + 3	142	140	142	1.000	0.989
1977 EOB + 4	146	149	150	0.973	0.993
1974 EOB	135	131	159	0.849	0.825
1975 EOB + 1	131	131	136	0.963	0.964
1976 EOB + 2	125	125	128	0.977	0.980
1977 EOB + 3	145	145	147	0.986	0.988
1975 EOB	87	90	103	0.845	0.872
1976 EOB + 1	90	87	91	0.989	0.957
1977 EOB + 2	106	103	106	1.000	0.972
1976 EOB	76	72	81	0.938	0.888
1977 EOB + 1	75	75	78	0.962	0.959
1977 EOB	98	99	109	0.899	0.906

Table 5—continued

Source=ROTC Rating=Nonrated Component=Reserve					
Fiscal Year	Stays	Stays-D[a]	Inventory	Rate	Rate-D[a]
1973 EOB	751	682	1606	0.468	0.424
1974 EOB + 1	580	582	697	0.832	0.834
1975 EOB + 2	501	494	546	0.918	0.905
1976 EOB + 3	467	461	498	0.938	0.926
1977 EOB + 4	409	414	440	0.930	0.941
1974 EOB	732	735	1783	0.411	0.412
1975 EOB + 1	555	576	678	0.819	0.850
1976 EOB + 2	489	477	526	0.930	0.908
1977 EOB + 3	432	435	468	0.923	0.929
1975 EOB	596	693	1644	0.363	0.422
1976 EOB + 1	478	464	548	0.872	0.846
1977 EOB + 2	380	394	435	0.874	0.907
1976 EOB	717	767	1807	0.397	0.425
1977 EOB + 1	493	489	580	0.850	0.843
1977 EOB	806	668	1572	0.513	0.425
Component=Regular					
1973 EOB	356	351	395	0.901	0.889
1974 EOB + 1	351	353	376	0.934	0.940
1975 EOB + 2	357	354	365	0.978	0.969
1976 EOB + 3	343	343	350	0.980	0.981
1977 EOB + 4	356	359	363	0.981	0.989
1974 EOB	459	436	561	0.818	0.778
1975 EOB + 1	458	458	486	0.942	0.942
1976 EOB + 2	449	452	467	0.961	0.968
1977 EOB + 3	443	451	460	0.963	0.981
1975 EOB	444	411	542	0.819	0.758
1976 EOB + 1	458	451	481	0.952	0.938
1977 EOB + 2	471	471	487	0.967	0.967
1976 EOB	315	317	403	0.782	0.787
1977 EOB + 1	419	410	442	0.948	0.928
1977 EOB	235	246	295	0.797	0.835

Table 5—continued

Source=OTS Rating=Pilot Component=Reserve					
Fiscal Year	Stays	Stays-D[a]	Inventory	Rate	Rate-D[a]
1973 EOB	197	400	723	0.272	0.553
1974 EOB + 1	173	165	186	0.930	0.890
1975 EOB + 2	151	157	162	0.932	0.971
1976 EOB + 3	133	140	143	0.930	0.979
1977 EOB + 4	121	122	124	0.976	0.982
1974 EOB	373	625	1138	0.328	0.549
1975 EOB + 1	292	301	327	0.893	0.922
1976 EOB + 2	274	272	288	0.951	0.943
1977 EOB +,3	234	241	253	0.925	0.954
1975 EOB	385	450	737	0.522	0.611
1976 EOB + 1	338	313	359	0.942	0.872
1977 EOB + 2	286	285	318	0.899	0.897
1976 EOB	373	455	753	0.495	0.604
1977 EOB + 1	306	289	343	0.892	0.841
1977 EOB	542	600	1053	0.515	0.570
Component=Regular					
1973 EOB	426	448	587	0.726	0.763
1974 EOB + 1	407	395	428	0.951	0.924
1975 EOB + 2	398	398	404	0.985	0.985
1976 EOB + 3	388	398	402	0.965	0.989
1977 EOB + 4	377	388	393	0.959	0.987
1974 EOB	388	446	532	0.729	0.838
1975 EOB + 1	403	400	414	0.973	0.966
1976 EOB + 2	389	390	400	0.972	0.976
1977 EOB + 3	391	391	402	0.973	0.974
1975 EOB	426	467	505	0.844	0.924
1976 EOB + 1	422	415	435	0.970	0.954
1977 EOB + 2	418	412	431	0.970	0.957
1976 EOB	339	369	399	0.850	0.924
1977 EOB + 1	313	322	343	0.913	0.940
1977 EOB	414	418	459	0.902	0.910

Table 5—continued

Source=OTS	Rating=Navigator	Component=Reserve			
Fiscal Year	Stays	Stays-D[a]	Inventory	Rate	Rate-D[a]
1973 EOB	106	121	205	0.517	0.589
1974 EOB + 1	75	89	101	0.743	0.883
1975 EOB + 2	68	65	68	1.000	0.951
1976 EOB + 3	57	56	58	0.983	0.967
1977 EOB + 4	39	41	42	0.929	0.977
1974 EOB	126	155	282	0.447	0.551
1975 EOB + 1	82	99	108	0.759	0.914
1976 EOB + 2	74	73	77	0.961	0.946
1977 EOB + 3	37	40	42	0.881	0.958
1975 EOB	101	110	193	0.523	0.569
1976 EOB + 1	88	82	91	0.967	0.900
1977 EOB + 2	58	60	64	0.906	0.938
1976 EOB	71	90	154	0.461	0.582
1977 EOB + 1	54	56	62	0.871	0.909
1977 EOB	271	305	517	0.524	0.590
Component=Regular					
1973 EOB	133	146	173	0.769	0.844
1974 EOB + 1	114	124	133	0.857	0.933
1975 EOB + 2	110	110	112	0.982	0.980
1976 EOB + 3	115	117	118	0.975	0.990
1977 EOB + 4	124	125	126	0.984	0.991
1974 EOB	98	124	150	0.653	0.829
1975 EOB + 1	106	111	115	0.922	0.961
1976 EOB + 2	104	103	105	0.990	0.978
1977 EOB + 3	132	133	135	0.978	0.987
1975 EOB	117	138	157	0.745	0.879
1976 EOB + 1	119	118	123	0.967	0.959
1977 EOB + 2	136	135	139	0.978	0.972
1976 EOB	109	124	139	0.784	0.893
1977 EOB + 1	112	109	114	0.982	0.958
1977 EOB	233	242	266	0.876	0.908

Table 5—continued

Fiscal Year	Stays	Stays-D[a]	Inventory	Rate	Rate-D[a]
Source=OTS Rating=Nonrated Component=Reserve					
1973 EOB	489	547	1310	0.373	0.417
1974 EOB + 1	326	374	450	0.724	0.832
1975 EOB + 2	260	266	294	0.884	0.904
1976 EOB + 3	242	239	258	0.938	0.925
1977 EOB + 4	218	219	233	0.936	0.940
1974 EOB	502	569	1407	0.357	0.404
1975 EOB + 1	359	388	458	0.784	0.847
1976 EOB + 2	316	314	346	0.913	0.907
1977 EOB + 3	281	283	305	0.921	0.929
1975 EOB	259	285	687	0.377	0.414
1976 EOB + 1	202	199	236	0.856	0.844
1977 EOB + 2	152	161	178	0.854	0.906
1976 EOB	231	214	511	0.452	0.419
1977 EOB + 1	171	165	196	0.872	0.840
1977 EOB	112	84	201	0.557	0.417
Component=Regular					
1973 EOB	337	381	426	0.791	0.894
1974 EOB + 1	312	325	344	0.907	0.944
1975 EOB + 2	319	317	326	0.979	0.971
1976 EOB + 3	300	307	312	0.962	0.982
1977 EOB + 4	296	305	308	0.961	0.990
1974 EOB	242	261	329	0.736	0.793
1975 EOB + 1	241	245	260	0.927	0.943
1976 EOB + 2	238	241	249	0.956	0.968
1977 EOB + 3	236	238	243	0.971	0.981
1975 EOB	157	149	192	0.818	0.777
1976 EOB + 1	159	159	169	0.941	0.940
1977 EOB + 2	171	172	178	0.961	0.967
1976 EOB	42	37	47	0.894	0.797
1977 EOB + 1	65	64	69	0.942	0.923
1977 EOB	20	22	25	0.800	0.871

[a]D indicates the prediction of the Dynamic Retention Model.

VIII. COMPETING MODELS

An important component of the evaluation of the dynamic retention model should be how closely it predicts actual retention rates relative to the predictions of competing models. We have estimated the parameters of two competing models using the same information on retention decisions for the same sample period as that used for estimation of the dynamic retention model. Both models are closely related to the stochastic dynamic programming approach presented in Sec. III.[1]

THE PVCOL MODEL

The first competing model is the Present Value Cost of Leaving (PVCOL) model.[2] In it there are no persistent differences among individuals and, hence, no selection effects of the types discussed in previous sections. Further, although there are transient effects disturbing individual decisions, individuals persist in behaving as if the current disturbance will be the last.

Consider the functional Eq. (3) with γ_k and ϵ_{kt} both identically zero for all k and t. The return from staying, $A_{t+1}(j,\gamma_k)$ in Eq. (6), reduces to

$$PA_{t+1}(j) = \beta \sum_{\ell=j}^{53} s_{t+1,t+2} P_{j\ell t+1}[m_{\ell,t+2} + V_{t+2}(\ell)] + P_{j,54,t+1}[\beta s_{t+1,t+2}\, \mathrm{spay}_{t+1}(j) + U_{t+1}(j)] \ . \quad (20)$$

Note that the optimal return, V, no longer depends on γ and ϵ . Now the cost of leaving for the individual in state j at year of service $t + 1$ is defined by

$$pc_{t+1}(j) = PA_{t+1}(j) - U_{t+1}(j) \ . \quad (21)$$

Now $pc_{t+1}(j)$ applies to all individuals in the indicated state and year of service group. Adding a random disturbance ξ_{kt} (for the kth individual in the tth year of service) to $pc_t(i)$ completes the model. If $pc_t(i) + \xi_{kt}$ exceeds zero, then the individual will remain in the military at least one more year; otherwise he will leave. If ξ is identically, independently, normally distributed with mean δ and variance ρ^2 , then the probability that an individual in state i in year of service t will choose to remain in the Air Force for at least one more year is

$$RET_t(i) = 1 - \Phi(-[pc_t(i) + \delta]/\rho) = \Phi([pc_t(i) + \delta]/\rho) \quad (22)$$

where Φ is the standard normal distribution function. The parameters δ and ρ were separately estimated for each of the nine combinations of aeronautical rating and source of commission using maximum likelihood. The parameter estimates are presented in Table 6.

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[1]Many retention models estimated for military personnel are not special cases of the stochastic dynamic programming approach. None of these models is able to address the classes of compensation, retirement, and personnel policy changes that can be analyzed by the dynamic retention model and the two competing models.

[2]We first presented this dynamic programming model in unpublished Rand research in 1977 and later in Gotz and McCall (1979). More recently it appeared in Gotz and McCall (1983). Warner (1979) coined the term PVCOL for it.

Table 6

PARAMETER ESTIMATES OF PVCOL MODEL
(Measured in thousands of dollars)

Rating and Source of Commission	δ	ρ
Pilots		
Academy	21.2	34.6
ROTC	25.8	22.7
OTS/other	29.6	23.7
Navigators		
Academy	47.5	19.8
ROTC	42.1	19.3
OTS/other	50.0	17.6
Nonrated		
Academy	30.4	20.3
ROTC	33.1	13.3
OTS/other	33.6	14.6

THE ACOL MODEL

The second competing model is a variation of one commonly used in the Department of Defense for predicting the reenlistment rates of enlisted personnel. Our development shows that it is a special case of the dynamic retention model presented above. The presentation of the model by Warner (1979), and Enns, Nelson, and Warner (1981) has only one military state; with that exception, their development and the one below are formally equivalent.

Consider the functional Eq. (3) with ϵ_{kt} identically equal to zero for all k and t . The optimal return, V , no longer depends on the transient disturbance, so individuals in this model are assumed to know with certainty the year of service in which they would leave the military for each military state i. The return from staying, $AA_t(i,\gamma_k)$ is

$$AA_t(i,\gamma_k) = \beta \sum_{j=i}^{53} s_{t,t+1} P_{ijt} \{\gamma_k + m_{j,t+1} + V_{t+1}(j,\gamma_k)\}$$
$$+ P_{i,54,t}[\beta s_{t,t+1}\,\mathrm{spay}_t(i) + U_t(i)] \quad . \tag{23}$$

The cost of leaving for the individual in state i in year of service t and with $\gamma = \gamma_k$ is defined by

$$ac_t(i,\gamma_k) = AA_t(i,\gamma_k) - U_t(i) \quad . \tag{24}$$

The individual will remain in the military at least one more year if and only if $ac_t(i,\gamma_k)$ exceeds zero.

Now define ACOL(i,t) as the value of γ that sets the cost of leaving in Eq. (24) equal to zero. ACOL(i,t) may be interpreted as the additional certain equivalent annuity that would make the individual maximizing the present value of income indifferent between remaining at least one more year and leaving. For this reason Warner termed this the Annualized Cost of Leaving (ACOL) model.

The probability that an individual in state i in year of service t will choose to remain at least one more year is the probability that $\gamma >$ ACOL(i,t). To be consistent with Warner (1979), and Enns, Nelson and Warner (1981), we assume that γ is identically, independently, logistically distributed across individuals and over time. Implicit in this is that each individual's taste for the service does not persist from one year to the next. Despite this, the individual in this model behaves as if his taste for the service were never going to change![3] Thus, the retention probability is given by

$$RET_t(i) = \{1 + \exp[(\mathrm{ACOL}(i,t) - \upsilon)/\delta]\}^{-1} \quad , \tag{25}$$

where υ is the mean of γ in this model, and 1.81137δ is the standard deviation.

The parameters υ and δ were estimated by maximum likelihood. The estimates for each of the nine rating/source of commission combinations are presented in Table 7.

Table 7

PARAMETER ESTIMATES OF ACOL MODEL

Rating and Source of Commission	υ	1.8δ
Pilots		
Academy	-2.3	8.3
ROTC	-7.2	1.5
OTS/other	-7.7	1.2
Navigators		
Academy	-7.4	2.0
ROTC	-6.7	4.3
OTS/other	-8.3	4.0
Nonrated		
Academy	-2.8	4.2
ROTC	-9.6	4.1
OTS/other	-9.8	4.4

[3]This internal inconsistency in the model would be eliminated by assuming that γ persists over time. In the absence of transient disturbances, however, this gives rise to predictions inconsistent with observed behavior. Specifically, if ACOL($i,t+1$) > ACOL(i,t) the predicted retention probability in state i during year of $t+1$ is one. The data show that this is false more often than it is true. Adding a random disturbance to ACOL(i,t) would eliminate such predictions, but at the cost of assuming that individuals persist in behaving as if the current transient disturbance will be the last.

Other, ad hoc, fixes to the model have been proposed. These include (1) adding a variable, log (t), to the logistic regression because it is correlated with the mean of the taste distribution, and (2) adding ACOL($i,t-1$) to the logistic regression. The logical consistency of these fixes with the basic model is, at best, unclear.

Table 8 presents the χ^2 statistics and degrees of freedom for the PVCOL and ACOL models as well as for the dynamic retention model. Because the PVCOL model is a special case of the dynamic retention model, the differences in the χ^2 values of these two models are themselves χ^2 with degrees of freedom equal to the differences in the respective degrees of freedom. The probability distribution of γ in the ACOL model was assumed to be logistic rather than extreme value, so the differences in the χ^2 statistics from the dynamic retention model have an unknown distribution. Nevertheless, comparison of the statistics gives a clear indication of the differences in fit.

An alternative way to quantify the relative goodness of fits of the models is the following.[4] Each χ^2 statistic tests the hypothesis that the true retention probabilities are actually of the form specified by the model. Suppose instead that there is an additional source of (extra-binomial) variation in the true retention probabilities; that is, suppose that the true probabilities are of the form

$$\text{true probability for cell } \underset{\sim}{i}_t = p_{\underset{\sim}{i}_t} + U_{\underset{\sim}{i}_t} \ ,$$

where $\{p_{\underset{\sim}{i}_t}\}$ are explained by the retention model, and $\{U_{\underset{\sim}{i}_t}\}$ are identically, independently distributed random variables with mean zero and variance η^2. Thus,

$$E(r_{\underset{\sim}{i}_t} - p_{\underset{\sim}{i}_t})^2 = \sigma^2_{\underset{\sim}{i}_t} + \eta^2 \ ,$$

Table 8

χ^2 STATISTICS AND DEGREES OF FREEDOM FOR THE COMPETING MODELS

Rating and Source of Commission	Dynamic Retention Model		ACOL		PVCOL	
	χ^2	d.f.	χ^2	d.f.	χ^2	d.f.
Pilots						
Academy	175	74	445	75	484	75
ROTC	422	132	3,632	134	1870	134
OTS/other	1132	126	16,210	128	2731	128
Navigators						
Academy	21	36	22	37	30	37
ROTC	124	104	268	106	488	106
OTS/other	378	122	318	124	715	124
Nonrated						
Academy	32	24	30	25	38	25
ROTC	1041	86	2760	88	4137	88
OTS/other	682	77	1510	79	2376	79

[4]The test and much of the text presented below were drawn directly from two unpublished papers by Rand colleague Robert Bell. Also see Williams (1982).

where $\sigma^2_{i_t} = p_{i_t}(1 - p_{i})/n_{i_t}$ is the binomial variance, and η^2 is the variance due to lack of fit. An obvious test statistic for $H_0 : \eta^2 = c$ is

$$\sum_t \sum_{i_t} \frac{(r_{i_t} - p_{i_t})^2}{\sigma^2_{i_t} + c} \ . \tag{26}$$

For the hypothesis that the k-parameter model fits $(H_0 : \eta^2 = 0)$ this is Pearson's χ^2 statistic, $\chi^2(N - k)$. Because there are $N - k$ degrees of freedom, this will have expectation $N - k$.

Often, it is possible to derive estimators from tests of hypotheses by using the parameter estimate for which the test is farthest from rejecting. In this case, that would occur for the value of c in Eq. (26) such that the summation equals its expectation. Thus $\hat{\eta}^2$ is defined implicitly by

$$S(\hat{\eta}^2) \triangleq \sum_t \sum_{i_t} \frac{(r_{i_t} - p_{i_t})^2}{\sigma^2_{i_t} + \hat{\eta}^2} - (N - k) = 0 \ . \tag{27}$$

S is monotone decreasing in η^2 so that negative values of η^2 are implied by $\chi^2(N - k) < N - k$ and positive values are implied by $\chi^2(N - k) > N - k$.

The χ^2 measure is much more sensitive to sample size than the η^2 measure. Hence, the goodness-of-fit orderings might differ between the criteria. This would occur if one model predicts large cells better and smaller cells worse than another model.

Table 9 contains the estimated values of η^2 for each of the nine rating/source of commission groups for each model. For comparison, we also include the χ^2 values for each group and model.

Table 9

GOODNESS-OF-FIT STATISTICS FOR THE COMPETING MODELS

Rating and Source of Commission	Dynamic Retention Model		ACOL		PVCOL	
	$\eta 2$ (× 100)	$\chi 2$	$\eta 2$ (× 100)	$\chi 2$	$\eta 2$ (× 100)	$\chi 2$
Pilots						
Academy	.083	178	.234	445	.318	484
ROTC	.174	423	1.754	3,632	1.784	1870
OTS/other	.664	1132	3.822	16,210	2.868	2730
Navigators						
Academy	-.245	22	-.281	22	-.078	30
ROTC	.012	123	.389	268	1.211	488
OTS/other	.381	378	.388	318	2.173	715
Nonrated						
Academy	.025	32	.016	30	.041	38
ROTC	2.818	1041	3.573	2,760	4.173	4137
OTS/other	1.870	682	2.202	1,510	3.078	2376

The χ^2 statistics appear to indicate that the dynamic retention model predicts better for *small* cells than for large cells relative to the other models. That is, the relative magnitudes of the χ^2 statistics between models are closer than are the η^2 statistics.

What the statistics above do not indicate are systematic errors in prediction. Assuming that the dynamic retention model is the appropriate model, we should observe the following systematic prediction errors in the PVCOL and ACOL models. First, because the independent variables in the two competing models are imperfectly correlated with the conditional mean of the taste distribution over years of service, these models should overpredict retention at the first decision point (EOB) and underpredict subsequent years' retention. Because the two competing models do not account for the selection of high taste officers into the regular component, these models should underpredict the *difference* between regular and reserve retention rates at the first decision point. Thus, reserve retention at EOB should be overpredicted and total (regular and reserve) retention at EOB should be overpredicted. There are opposing effects for regular retention at EOB. Where the dispersion of tastes is small—Academy navigators and nonrated officers—the systematic underprediction should be small. Because Academy pilots are all regular officers, the EOB retention of this group should be systematically overpredicted and subsequent years' retention underpredicted.

These systematic prediction errors for the ACOL and PVCOL models can be observed in Table 10, which contains the actual and predicted numbers of stayers for the dynamic retention model (STAYS − D), the PVCOL model (STAYS − P), and the ACOL model (STAYS − A) as well as the number of officers at risk and the predicted retention rates. The cells are defined exactly as were those in Table 5.

There are 150 rows representing post-EOB years of service added over sources of commission and aeronautical ratings in Table 10. A simple count of the number of times each model over, under, or exactly predicted the number of stayers yielded the following results. The dynamic retention model overpredicted on 64 cases, underpredicted in 63 cases, and predicted exactly in 23 cases. The ACOL model overpredicted 16 times, underpredicted 124 times, and predicted exactly 10 times. The PVCOL model's performance was roughly the same as the ACOL model's. Even in those cases where the ACOL had a smaller χ^2 value than did the dynamic retention model (e.g., OTS navigators), the ACOL model systematically underpredicted the post-EOB retention rates.

Examination of Table 10 also yields the conclusion that the ACOL and PVCOL models systematically underpredict the difference between regular and reserve retention rates and that these models overpredict reserve retention rates at EOB by very large amounts. Although not evident from the table without additional calculations, the ACOL and PVCOL models uniformly overpredict total EOB retention (regular + reserve) except in the cases of Academy navigators and nonrated officers. The dispersion in tastes in these groups is estimated to be small.

Table 10

PREDICTED AND ACTUAL YEAR GROUP RETENTION FOR THE COMPETING MODELS

Source=Academy Rating=Pilot Component=Regular

Fiscal Year	Stays	Stays-D	Stays-P	Stays-A	Inv	Rate	Rate-D	Rate-P	Rate-A
1973 EOB	235	225	256	246	292	0.805	0.771	0.876	0.841
1974 EOB + 1	222	214	200	198	230	0.965	0.930	0.867	0.863
1975 EOB + 2	213	217	208	208	218	0.977	0.996	0.952	0.952
1976 EOB + 3	208	210	194	200	211	0.986	0.995	0.922	0.947
1977 EOB + 4	202	206	186	193	207	0.976	0.993	0.899	0.933
1974 EOB	254	252	281	262	339	0.749	0.745	0.830	0.772
1975 EOB + 1	241	243	235	236	249	0.968	0.978	0.944	0.947
1976 EOB + 2	230	229	217	218	231	0.996	0.991	0.940	0.945
1977 EOB + 3	225	226	205	212	230	0.978	0.985	0.891	0.921
1975 EOB	303	332	374	375	400	0.757	0.830	0.935	0.938
1976 EOB + 1	292	288	279	281	300	0.973	0.960	0.930	0.938
1977 EOB + 2	280	277	255	262	289	0.969	0.958	0.883	0.905
1976 EOB	215	201	225	227	244	0.881	0.823	0.923	0.931
1977 EOB + 1	195	188	177	181	204	0.956	0.923	0.869	0.888
1977 EOB	333	322	356	350	420	0.793	0.767	0.847	0.832

Table 10—continued

Fiscal Year	Stays	Stays-D	Stays-P	Stays-A	Inv	Rate	Rate-D	Rate-P	Rate-A
Source=Academy Rating=Navigator Component=Regular									
1973 EOB	43	42	45	43	48	0.896	0.878	0.940	0.905
1974 EOB + 1	36	35	36	35	40	0.900	0.886	0.898	0.887
1975 EOB + 2	33	33	32	32	34	0.971	0.962	0.935	0.955
1976 EOB + 3	31	30	29	30	31	1.000	0.982	0.944	0.975
1977 EOB + 4	31	31	28	31	31	1.000	0.985	0.890	0.987
1974 EOB	35	35	38	35	44	0.795	0.787	0.864	0.793
1975 EOB + 1	32	31	31	31	34	0.941	0.919	0.919	0.912
1976 EOB + 2	30	30	29	29	31	0.968	0.955	0.928	0.943
1977 EOB + 3	28	29	28	29	30	0.933	0.977	0.931	0.967
1975 EOB	14	14	15	14	16	0.875	0.879	0.917	0.904
1976 EOB + 1	13	13	13	13	14	0.929	0.931	0.927	0.939
1977 EOB + 2	11	11	10	11	11	1.000	0.964	0.930	0.965
1976 EOB	47	47	50	49	55	0.855	0.861	0.908	0.885
1977 EOB + 1	40	41	41	42	45	0.889	0.914	0.910	0.923
1977 EOB	48	46	48	47	53	0.906	0.863	0.899	0.892
Source=Academy Rating=Nonrated Component=Regular									
1973 EOB	159	166	176	170	197	0.807	0.844	0.892	0.863
1974 EOB + 1	118	122	121	123	144	0.819	0.845	0.842	0.851
1975 EOB + 2	111	106	104	105	117	0.949	0.906	0.890	0.895
1976 EOB + 3	96	93	90	90	99	0.970	0.938	0.912	0.911
1977 EOB + 4	90	93	90	82	96	0.938	0.967	0.936	0.851
1974 EOB	144	143	145	147	180	0.800	0.792	0.804	0.815
1975 EOB + 1	126	121	120	120	139	0.906	0.867	0.866	0.866
1976 EOB + 2	114	114	112	110	125	0.912	0.910	0.895	0.882
1977 EOB + 3	94	99	97	93	105	0.895	0.945	0.920	0.884
1975 EOB	187	184	188	187	224	0.835	0.820	0.838	0.836
1976 EOB + 1	157	157	157	156	180	0.872	0.870	0.872	0.869
1977 EOB + 2	142	142	140	141	156	0.910	0.912	0.899	0.903
1976 EOB	188	178	182	181	216	0.870	0.824	0.845	0.840
1977 EOB + 1	150	157	158	158	180	0.833	0.874	0.877	0.877
1977 EOB	212	202	207	207	244	0.869	0.828	0.850	0.847

Table 10—continued

Fiscal Year	Stays	Stays-D	Stays-P	Stays-A	Inv	Rate	Rate-D	Rate-P	Rate-A
Source=ROTC Rating=Pilot Component=Reserve									
1973 EOB	215	279	369	389	541	0.397	0.517	0.683	0.718
1974 EOB + 1	184	183	132	149	207	0.889	0.884	0.637	0.720
1975 EOB + 2	159	171	155	154	176	0.903	0.969	0.880	0.878
1976 EOB + 3	146	150	123	128	153	0.954	0.978	0.802	0.835
1977 EOB + 4	126	127	79	86	130	0.969	0.980	0.609	0.659
1974 EOB	277	335	392	472	665	0.417	0.504	0.589	0.709
1975 EOB + 1	227	220	213	205	240	0.946	0.915	0.886	0.854
1976 EOB + 2	210	206	178	180	220	0.955	0.938	0.808	0.819
1977 EOB + 3	187	187	118	140	197	0.949	0.949	0.599	0.709
1975 EOB	295	305	477	450	543	0.543	0.562	0.878	0.828
1976 EOB + 1	252	231	218	220	269	0.937	0.860	0.809	0.819
1977 EOB + 2	221	207	142	171	234	0.944	0.886	0.607	0.731
1976 EOB	148	136	198	201	245	0.604	0.556	0.808	0.820
1977 EOB + 1	119	112	83	100	136	0.875	0.826	0.612	0.736
1977 EOB	429	445	504	631	847	0.506	0.525	0.596	0.746
Component=Regular									
1973 EOB	667	598	692	622	813	0.820	0.736	0.851	0.765
1974 EOB + 1	638	614	556	515	668	0.955	0.919	0.833	0.772
1975 EOB + 2	617	623	615	630	633	0.975	0.985	0.972	0.995
1976 EOB + 3	606	610	596	615	617	0.982	0.989	0.967	0.997
1977 EOB + 4	588	602	558	560	610	0.964	0.987	0.915	0.918
1974 EOB	552	555	551	531	695	0.794	0.799	0.793	0.764
1975 EOB + 1	553	544	547	538	565	0.979	0.962	0.967	0.952
1976 EOB + 2	542	537	530	526	552	0.982	0.973	0.960	0.953
1977 EOB + 3	536	535	494	462	551	0.973	0.971	0.897	0.839
1975 EOB	433	447	478	437	498	0.869	0.897	0.960	0.878
1976 EOB + 1	432	418	422	391	443	0.975	0.943	0.952	0.882
1977 EOB + 2	416	414	381	352	437	0.952	0.946	0.873	0.806
1976 EOB	248	253	267	241	282	0.879	0.897	0.947	0.856
1977 EOB + 1	243	231	214	200	250	0.972	0.926	0.856	0.799
1977 EOB	465	487	446	430	539	0.863	0.904	0.828	0.798

Table 10—continued

Fiscal Year	Stays	Stays-D	Stays-P	Stays-A	Inv	Rate	Rate-D	Rate-P	Rate-A
Source=ROTC Rating=Navigator Component=Reserve									
1973 EOB	81	85	116	101	143	0.566	0.596	0.814	0.704
1974 EOB + 1	65	69	55	51	78	0.833	0.885	0.707	0.653
1975 EOB + 2	60	58	47	55	61	0.984	0.952	0.775	0.900
1976 EOB + 3	53	52	40	51	54	0.981	0.968	0.736	0.939
1977 EOB + 4	41	41	28	40	42	0.976	0.977	0.676	0.950
1974 EOB	83	74	91	83	131	0.634	0.561	0.692	0.634
1975 EOB + 1	71	69	59	60	75	0.947	0.917	0.781	0.806
1976 EOB + 2	65	66	54	63	70	0.929	0.948	0.771	0.902
1977 EOB + 3	32	33	24	31	34	0.941	0.959	0.692	0.904
1975 EOB	63	67	89	79	116	0.543	0.579	0.769	0.685
1976 EOB + 1	52	49	43	44	54	0.963	0.905	0.789	0.815
1977 EOB + 2	31	31	26	29	33	0.939	0.937	0.778	0.893
1976 EOB	42	42	56	52	71	0.592	0.588	0.785	0.726
1977 EOB + 1	28	32	29	31	35	0.800	0.913	0.837	0.887
1977 EOB	97	102	143	132	171	0.567	0.596	0.835	0.771
Component=Regular									
1973 EOB	149	151	171	167	180	0.828	0.837	0.951	0.930
1974 EOB + 1	141	138	132	124	148	0.953	0.931	0.894	0.835
1975 EOB + 2	139	139	133	139	142	0.979	0.979	0.938	0.976
1976 EOB + 3	142	140	134	140	142	1.000	0.989	0.943	0.987
1977 EOB + 4	146	149	139	149	150	0.973	0.993	0.929	0.990
1974 EOB	135	131	138	113	159	0.849	0.825	0.870	0.708
1975 EOB + 1	131	131	126	129	136	0.963	0.964	0.928	0.949
1976 EOB + 2	125	125	120	125	128	0.977	0.980	0.934	0.973
1977 EOB + 3	145	145	137	145	147	0.986	0.988	0.933	0.984
1975 EOB	87	90	94	87	103	0.845	0.872	0.913	0.846
1976 EOB + 1	90	87	84	85	91	0.989	0.957	0.924	0.939
1977 EOB + 2	106	103	98	102	106	1.000	0.972	0.922	0.966
1976 EOB	76	72	74	73	81	0.938	0.888	0.918	0.902
1977 EOB + 1	75	75	71	74	78	0.962	0.959	0.916	0.949
1977 EOB	98	99	99	96	109	0.899	0.906	0.904	0.882

Table 10—continued

Source=ROTC Rating=Nonrated Component=Reserve									
Fiscal Year	Stays	Stays-D	Stays-P	Stays-A	Inv	Rate	Rate-D	Rate-P	Rate-A
1973 EOB	751	682	1164	1120	1606	0.468	0.424	0.725	0.698
1974 EOB + 1	580	582	391	354	697	0.832	0.834	0.561	0.508
1975 EOB + 2	501	494	336	407	546	0.918	0.905	0.616	0.745
1976 EOB + 3	467	461	315	410	498	0.938	0.926	0.632	0.822
1977 EOB + 4	409	414	282	387	440	0.930	0.941	0.640	0.879
1974 EOB	732	735	948	614	1783	0.411	0.412	0.532	0.345
1975 EOB + 1	555	576	397	418	678	0.819	0.850	0.586	0.617
1976 EOB + 2	489	477	322	393	526	0.930	0.908	0.612	0.747
1977 EOB + 3	432	435	301	390	468	0.923	0.929	0.642	0.833
1975 EOB	596	693	970	861	1644	0.363	0.422	0.590	0.524
1976 EOB + 1	478	464	320	342	548	0.872	0.846	0.585	0.624
1977 EOB + 2	380	394	269	330	435	0.874	0.907	0.619	0.759
1976 EOB	717	767	1084	993	1807	0.397	0.425	0.600	0.550
1977 EOB + 1	493	489	342	369	580	0.850	0.843	0.590	0.636
1977 EOB	806	668	946	876	1572	0.513	0.425	0.602	0.557
Component=Regular									
1973 EOB	356	351	364	367	395	0.901	0.889	0.922	0.928
1974 EOB + 1	351	353	331	342	376	0.934	0.940	0.881	0.910
1975 EOB + 2	357	354	341	350	365	0.978	0.969	0.934	0.959
1976 EOB + 3	343	343	334	341	350	0.980	0.981	0.955	0.974
1977 EOB + 4	356	359	353	357	363	0.981	0.989	0.972	0.983
1974 EOB	459	436	468	467	561	0.818	0.778	0.833	0.833
1975 EOB + 1	458	458	445	457	486	0.942	0.942	0.915	0.941
1976 EOB + 2	449	452	438	449	467	0.961	0.968	0.938	0.961
1977 EOB + 3	443	451	441	449	460	0.963	0.981	0.959	0.976
1975 EOB	444	411	479	489	542	0.819	0.758	0.883	0.902
1976 EOB + 1	458	451	442	454	481	0.952	0.938	0.920	0.944
1977 EOB + 2	471	471	458	469	487	0.967	0.967	0.940	0.962
1976 EOB	315	317	359	366	403	0.782	0.787	0.890	0.907
1977 EOB + 1	419	410	404	414	442	0.948	0.928	0.913	0.938
1977 EOB	235	246	262	268	295	0.797	0.835	0.889	0.908

Table 10—continued

Fiscal Year	Stays	Stays-D	Stays-P	Stays-A	Inv	Rate	Rate-D	Rate-P	Rate-A
Source=OTS Rating=Pilot Component=Reserve									
1973 EOB	197	400	448	446	723	0.272	0.553	0.620	0.616
1974 EOB + 1	173	165	106	115	186	0.930	0.890	0.571	0.618
1975 EOB + 2	151	157	135	138	162	0.932	0.971	0.834	0.853
1976 EOB + 3	133	140	106	113	143	0.930	0.979	0.744	0.789
1977 EOB + 4	121	122	67	66	124	0.976	0.982	0.543	0.533
1974 EOB	373	625	593	684	1138	0.328	0.549	0.521	0.601
1975 EOB + 1	292	301	275	268	327	0.893	0.922	0.840	0.819
1976 EOB + 2	274	272	216	221	288	0.951	0.943	0.751	0.769
1977 EOB + 3	234	241	135	151	253	0.925	0.954	0.533	0.597
1975 EOB	385	450	612	575	737	0.522	0.611	0.831	0.780
1976 EOB + 1	338	313	270	275	359	0.942	0.872	0.752	0.767
1977 EOB + 2	286	285	172	202	318	0.899	0.897	0.541	0.635
1976 EOB	373	455	565	578	753	0.495	0.604	0.751	0.768
1977 EOB + 1	306	289	187	220	343	0.892	0.841	0.546	0.642
1977 EOB	542	600	560	692	1053	0.515	0.570	0.532	0.657
Component=Regular									
1973 EOB	426	448	467	401	587	0.726	0.763	0.795	0.683
1974 EOB + 1	407	395	332	297	428	0.951	0.924	0.775	0.694
1975 EOB + 2	398	398	385	402	404	0.985	0.985	0.952	0.996
1976 EOB + 3	388	398	379	401	402	0.965	0.989	0.944	0.998
1977 EOB + 4	377	388	343	350	393	0.959	0.987	0.873	0.889
1974 EOB	388	446	388	362	532	0.729	0.838	0.729	0.681
1975 EOB + 1	403	400	391	389	414	0.973	0.966	0.946	0.939
1976 EOB + 2	389	390	374	376	400	0.972	0.976	0.935	0.939
1977 EOB + 3	391	391	342	317	402	0.973	0.974	0.850	0.788
1975 EOB	426	467	473	432	505	0.844	0.924	0.936	0.855
1976 EOB + 1	422	415	402	374	435	0.970	0.954	0.925	0.859
1977 EOB + 2	418	412	355	322	431	0.970	0.957	0.824	0.747
1976 EOB	339	369	367	328	399	0.850	0.924	0.919	0.823
1977 EOB + 1	313	322	276	252	343	0.913	0.940	0.805	0.735
1977 EOB	414	418	355	338	459	0.902	0.910	0.773	0.736

Table 10—continued

Fiscal Year	Stays	Stays-D	Stays-P	Stays-A	Inv	Rate	Rate-D	Rate-P	Rate-A
Source=OTS Rating=Navigator Component=Reserve									
1973 EOB	106	121	144	117	205	0.517	0.589	0.705	0.571
1974 EOB + 1	75	89	57	50	101	0.743	0.883	0.564	0.490
1975 EOB + 2	68	65	44	57	68	1.000	0.951	0.649	0.845
1976 EOB + 3	57	56	35	53	58	0.983	0.967	0.597	0.905
1977 EOB + 4	39	41	23	39	42	0.929	0.977	0.536	0.926
1974 EOB	126	155	152	134	282	0.447	0.551	0.540	0.474
1975 EOB + 1	82	99	71	75	108	0.759	0.914	0.657	0.696
1976 EOB + 2	74	73	50	65	77	0.961	0.946	0.646	0.847
1977 EOB + 3	37	40	23	36	42	0.881	0.958	0.542	0.848
1975 EOB	101	110	123	101	193	0.523	0.569	0.638	0.524
1976 EOB + 1	88	82	61	60	91	0.967	0.900	0.669	0.664
1977 EOB + 2	58	60	44	54	64	0.906	0.938	0.693	0.840
1976 EOB	71	90	102	92	154	0.461	0.582	0.664	0.597
1977 EOB + 1	54	56	45	50	62	0.871	0.909	0.732	0.809
1977 EOB	271	305	380	337	517	0.524	0.590	0.735	0.651
Component=Regular									
1973 EOB	133	146	159	156	173	0.769	0.844	0.917	0.904
1974 EOB + 1	114	124	110	103	133	0.857	0.933	0.826	0.772
1975 EOB + 2	110	110	100	109	112	0.982	0.980	0.895	0.969
1976 EOB + 3	115	117	107	116	118	0.975	0.990	0.904	0.983
1977 EOB + 4	124	125	108	124	126	0.984	0.991	0.854	0.983
1974 EOB	98	124	118	88	150	0.653	0.829	0.789	0.586
1975 EOB + 1	106	111	101	107	115	0.922	0.961	0.878	0.927
1976 EOB + 2	104	103	93	101	105	0.990	0.978	0.888	0.962
1977 EOB + 3	132	133	120	132	135	0.978	0.987	0.886	0.979
1975 EOB	117	138	134	124	157	0.745	0.879	0.855	0.787
1976 EOB + 1	119	118	107	113	123	0.967	0.959	0.872	0.917
1977 EOB + 2	136	135	121	132	139	0.978	0.972	0.868	0.952
1976 EOB	109	124	120	119	139	0.784	0.893	0.861	0.858
1977 EOB + 1	112	109	98	106	114	0.982	0.958	0.857	0.928
1977 EOB	233	242	223	221	266	0.876	0.908	0.839	0.830

Table 10—continued

Fiscal Year	Stays	Stays-D	Stays-P	Stays-A	Inv	Rate	Rate-D	Rate-P	Rate-A
Source=OTS Rating=Nonrated Component=Reserve									
1973 EOB	489	547	909	875	1310	0.373	0.417	0.694	0.668
1974 EOB + 1	326	374	243	220	450	0.724	0.832	0.541	0.489
1975 EOB + 2	260	266	174	210	294	0.884	0.904	0.592	0.715
1976 EOB + 3	242	239	157	205	258	0.938	0.925	0.608	0.794
1977 EOB + 4	218	219	143	199	233	0.936	0.940	0.614	0.853
1974 EOB	502	569	723	477	1407	0.357	0.404	0.514	0.339
1975 EOB + 1	359	388	258	271	458	0.784	0.847	0.564	0.591
1976 EOB + 2	316	314	203	248	346	0.913	0.907	0.588	0.717
1977 EOB + 3	281	283	188	245	305	0.921	0.929	0.616	0.804
1975 EOB	259	285	390	346	687	0.377	0.414	0.568	0.504
1976 EOB + 1	202	199	133	141	236	0.856	0.844	0.563	0.597
1977 EOB + 2	152	161	106	130	178	0.854	0.906	0.595	0.728
1976 EOB	231	214	295	270	511	0.452	0.419	0.577	0.528
1977 EOB + 1	171	165	111	119	196	0.872	0.840	0.567	0.609
1977 EOB	112	84	116	108	201	0.557	0.417	0.579	0.535
Component=Regular									
1973 EOB	337	381	380	385	426	0.791	0.894	0.892	0.903
1974 EOB + 1	312	325	293	305	344	0.907	0.944	0.851	0.888
1975 EOB + 2	319	317	297	308	326	0.979	0.971	0.910	0.946
1976 EOB + 3	300	307	292	301	312	0.962	0.982	0.936	0.964
1977 EOB + 4	296	305	295	301	308	0.961	0.990	0.958	0.976
1974 EOB	242	261	262	260	329	0.736	0.793	0.795	0.791
1975 EOB + 1	241	245	231	240	260	0.927	0.943	0.887	0.922
1976 EOB + 2	238	241	227	236	249	0.956	0.968	0.913	0.947
1977 EOB + 3	236	238	228	234	243	0.971	0.981	0.939	0.965
1975 EOB	157	149	164	169	192	0.818	0.777	0.855	0.880
1976 EOB + 1	159	159	151	157	169	0.941	0.940	0.894	0.928
1977 EOB + 2	171	172	163	169	178	0.961	0.967	0.915	0.948
1976 EOB	42	37	41	42	47	0.894	0.797	0.865	0.893
1977 EOB + 1	65	64	61	63	69	0.942	0.923	0.883	0.916
1977 EOB	20	22	22	22	25	0.800	0.871	0.863	0.892

NOTES: Each yeargroup in this table consists of those who reached the end of their active-duty service obligation (EOB) during the indicated fiscal year and had common sources of commission, aeronautical rating, and component. D indicates prediction of Dynamic Retention Model; P, that of the PVCOL model; and A, that of the ACOL model.

IX. OUT-OF-SAMPLE PREDICTIONS

The sample period for the data used in estimating the dynamic retention model was FY 1973 through FY 1977. Predictions of retention rates beyond these years are necessary for forecasting and policy analysis. Also, an assessment of the accuracy of the model's predictions for FY 1978 and later years is of obvious interest for prospective users of the model. In this section we describe the information necessary for evaluating the accuracy of the model's predictions. This same information is also necessary for using the model when forecasting the distribution of officers by year of service and grade in each future year. Then, currently lacking this information, we provide predictions of retention rates for FY 1978 through FY 1981 under certain assumptions and indicate the sensitivity of the results to the assumptions.

The retention rates that are important for forecasting the distribution of officers by year of service and grade are the proportions of officers who continue from one year of service to the next. These total retention rates are weighted averages of the retention rates of (1) those who are eligible to separate voluntarily, (2) those who have not yet completed their initial active duty service obligations, and (3) those who are ineligible to remain in the Air Force.

The dynamic retention model predicts the voluntary retention rates; it does not predict the distribution of initial active duty service commitments in a yeargroup of officers. This distribution is primarily determined by service rules and policies that may change from year to year. (An example is the elimination of the active duty service commitment associated with the award of a regular commission.) Now the voluntary retention rate for a group of officers strongly depends on how many voluntary retention decisions that group has already made. Hence, the proportions of officers not yet eligible, first-time eligible, second-time eligible, ..., to separate voluntarily in each year—the weights—are key parameters in predicting total retention. Because retention rates vary by aeronautical rating, source of commission, and component, the data must be stratified by the proportion of the officer force in each of these combinations as well.

These information requirements are less complex than they seem. For example, calculation of the number of officers in the ninth year of service making their third voluntary retention decision requires three pieces of information: the number of officers in the seventh year of service two years earlier making their first voluntary retention decision and the voluntary retention rates of this group for each of the two years. Of course, if active duty service commitment rules change so that some who ordinarily would be making their third retention decision become ineligible to do so, then the number making their third decision would decline, and the total retention rate in the ninth year of service would increase.

Gathering the data necessary to predict total retention rates was beyond the scope of the current study. However, the Manpower and Personnel Center (MPC) has the proper files and with some modifications of their software could generate the data in the future, if desired.

The Air Force was able to provide total retention rates by aeronautical rating, source of commission, and fiscal year (FY 1977 through FY 1981). The data were also broken down by regular and reserve commissions but the numbers of officers in each group were not consistent with regular force integration rates. For some reason there is a lengthy delay between receipt of a regular commission and the entry of that receipt into the personnel records. The Air Force also provided us with more aggregate retention statistics broken down by aeronautical rating, year of service, and fiscal year. For each year of service in these more aggregate statistics, the estimated fraction of personnel eligible to separate voluntarily was provided. The definitions of eligibility and ineligibility are somewhat different from those used in this study—e.g., including active duty service commitments incurred after completion of the initial active duty service commitment.[1] Also, the inventories of officers and numbers lost do not always match up between the aggregate statistics and the aggregated values of the disaggregate statistics. The problem seems especially severe for nonrated officers.

Except for nonrated officers, the Air Force data permit a rough idea of the accuracy of the dynamic retention model's prediction. Unfortunately, because these data are not as finely partitioned as we require and the definitions are different, we still have to make several assumptions concerning the distribution of active duty service obligations. Indeed, by judicious choice of assumptions, we might even be able to make our predictions match the actual total retention rates exactly. Although we have not tried to do this, the reader should be aware that the comparisons of actual versus predicted total retention rates for FY 1978 through FY 1981 we present below do not truly constitute a validation of the model. That must await the more detailed information on the distribution of active duty service commitments.

The data provided for nonrated officers present two problems in addition to that mentioned above. First, these data did not exclude officers with more than one year of prior enlisted service; these individuals constitute a larger proportion of nonrated officers than of pilots or navigators. Because most of the prior-enlisted-service officers are not commissioned through the Academy and ROTC, we could concentrate our attention on these two sources. However, the eligibility rates obtained from the aggregate retention statistics do not seem consistent with the formal rules for active duty service obligations. Until recently, acceptance of a regular commission required the nonrated officer to complete five, rather than four, years of service before becoming eligible to separate voluntarily. Eligibility to separate voluntarily upon completing four years should be no higher than the complement of the augmentation rate. The data do not show such consistency. We will therefore not examine out-of-sample predictions of retention rates for nonrated officers.

Prediction of the voluntary retention rates requires updated promotion and augmentation probabilities by aeronautical rating, source of commission, fiscal year, and year of service. These data must be embedded in the Markov process described in Sec. III to permit evaluation of the dynamic program. MPC provided these updated promotion and augmentation data.

The natural tool for predicting total retention rates is the same tool for projecting the grade and year of service distribution of the officer force: a model that keeps track of the number of individuals with specific attributes as they progress through years of service. Lacking such a model, we developed the following mathematical structure for calculating total retention rates.

For each aeronautical rating, let

$E(fy,yos)$ be the proportion of individuals in year of service *yos* in fiscal year *fy* who are eligible to separate voluntarily.

$PI(s,yrgp,yos,i)$ be the proportion of yeargroup *yrgp* from source s in year of service *yos* who occupy state i, where i is defined as

[1]These data were generated by MPCHO at the Manpower and Personnel Center not specifically for this study. Because their purpose was different from ours, their data do not exactly fit our needs. In Sec. V we described the procedure used for determining when an officer is first eligible to separate voluntarily. Conducting the procedure requires a history of the timing and length of each active duty service commitment for each officer in the tenth or earlier year of service.

$i = 1$ Regular captain ineligible to separate voluntarily.

$i = 2$ Reserve captain ineligible to separate voluntarily.

$i = 3,4,5,6$ Regular captain first eligible to separate voluntarily in years of service 5,6,7,8, respectively if nonrated, and years of service 6,7,8,9, if rated.

$i = 7,8,9,10$ Reserve captain first eligible to separate voluntarily in years of service 5,6,7,8, respectively if nonrated, and years of service 6,7,8,9, if rated.

$i = 11$ Separated from the Air Force.

$TP(i,j,fy)$ The probability of moving from state i to state j in fiscal year fy. (Year of service and yeargroup are implicit in the state definitions and fiscal year.)

$Paug(s,yrgp)$ The proportion of the yeargroup from source s offered regular commissions before reaching the end of the initial active-duty-service obligation. This is the same variable as p in Sec. IV. *Paug* equals 1.0 for Academy graduates.

Before anyone has voluntarily separated, the initial state distributions are:

$$PI(s,yrgp,4,1) = Paug(s,yrgp)$$
$$PI(s,yrgp,4,2) = 1 - Paug(s,yrgp)$$

for nonrated personnel, and

$$PI(s,yrgp,5,1) = Paug(s,yrgp)$$
$$PI(s,yrgp,5,2) = 1 - Paug(s,yrgp)$$

for rated personnel.

Because we have no information on the distribution of active-duty-service commitments for regulars versus reserves, we assume that reserve officers are likely to be eligible to leave earlier than regular officers. Thus, we assume that:

$$TP(2,7,fy) = MIN\{1,E(fy,6)/PI(s,yrgp,5,2)\}$$

$$TP(1,3,fy) = MAX\{0,(E(fy,6) - PI(s,yrgp,2))/PI(s,yrgp,5,1)\}$$

for rated officers. For nonrated officers the year-of-service index must be decremented by one. The assumption is that all reserve officers must be eligible to leave before any regular officer is eligible to leave during the first year in which anyone in the year group is eligible to leave. This assumption is strongest for nonrated officers because of the values of E. Academy nonrated officers may not voluntarily separate until completing five years of service. For subsequent years we assume that the remaining ineligible regular and reserve officers become eligible at the same rates.

Voluntary retention rates are reflected in the values of $TP(i,i,fy)$ for $i = 3,\ldots,10$. These are the probabilities of voluntarily remaining in the Air Force. The voluntary loss probabilities are $TP(i,11,fy)$ for $i = 3,\ldots,10$.

The cumulative proportion of the initial year group lost to the Air Force each year is

$$PI(s,yrgp,yos+1,11) = \sum_{i=3}^{11} PI(s,yrgp,yos,i)\ TP(i,11,fy) \ .$$

(Note that $fy = yrgp + yos$.) The retention rate for the yeargroup $yrgp$ from source s in year of service yos in fiscal year fy is

$$\text{Retention}(s,fy,yos) = \{1 - PI(s,yrgp,yos,11)\} / \{1 - PI(s,yrgp,yos-1,11\} \ .$$

Let $INVEN(s,fy,yos)$ be the number of officers from source of commission s in fiscal year fy in year of service yos. Then the total retention rate for the aeronautical rating in fiscal year fy in year of service yos is:

$$\text{Retention}(yos,fy) = \frac{\sum_{s=1}^{3} INVEN(s,fy,yos)\ \text{Retention}(s,fy,yos)}{\sum_{s=1}^{3} INVEN(s,fy,yos)} \ ,$$

where $s = 1,2,3$ indexes the Academy, ROTC, and OTS/other.

The key assumptions embedded in the prediction model are:

1. Eligibility to separate voluntarily is independent of source of commission (with the exception of Academy nonrated officers who may not leave until at least the sixth year of service).
2. After the first year during which some officers may separate voluntarily, regulars and reserves become eligible to separate voluntarily at the same rates.
3. Every rated officer is first eligible to leave no later than after completing eight years of service. (This is a strong assumption and is a probable source of prediction error.)
4. The eligibility rates are themselves assumed values rather than measured rates. (This is why we provide some sensitivity results.) They are derived from MPCHO data.
5. Only the retention rates of captains are predicted.

Table 11 contains actual and predicted total retention rates for pilots and Table 12 for navigators. For each fiscal year and year of service combination, the total retention rate from the aggregate MPCHO data and three predicted retention rates are presented. Next to each predicted retention rate is the assumed proportion of the inventory eligible to separate voluntarily in that year of service in that fiscal year. These numbers, which are found in the columns labeled E , are the eligibility proportions discussed above.

The retention rates are for each fiscal year; that is, they are cross sections. To follow a year group one must begin with the sixth year of service in a fiscal year and move to the seventh year of service in the following fiscal year, and continue in this fashion.

The predicted voluntary retention rates from the dynamic retention model are the same in each of the three sets of predicted total retention rates. Changes in the values of E are the source of the column differences in total retention.

Pilot retention in the later years of service in FY 1979 through FY 1981 is persistently overpredicted. There are two likely explanations for this. The first is simply that the dynamic retention model may understate the sensitivity of retention in these later years of service to

Table 11

TOTAL PILOT RETENTION RATES

(Percentages)

			Assumption 1		Assumption 2		Assumption 3	
FY	Yos	Actual	P	E	P	E	P	E
1977	6	92	94	15	94	15	96	10
	7	83	81	70	79	74	78	74
	8	88	90	75	89	80	85	95
	9	93	87	100	88	100	91	100
	10	96	95	100	95	100	95	100
1978	6	95	97	6	97	6	98	4
	7	79	78	60	76	63	75	63
	8	82	88	85	88	90	82	95
	9	86	85	100	86	100	89	100
	10	90	92	100	93	100	93	100
	11	95	94	100	94	100	95	100
1979	6	98	99	1	99	1	99	1
	7	75	77	56	76	53	75	53
	8	79	85	90	84	90	82	90
	9	81	85	100	87	100	92	100
	10	81	94	100	95	100	96	100
	11	87	96	100	96	100	96	100
1980	6	98	99	2	99	2	99	2
	7	75	81	62	82	57	82	57
	8	82	85	85	86	85	85	85
	9	88	93	100	95	100	97	100
	10	89	99	100	99	100	99	100
	11	93	99	100	99	100	100	100
1981	6	98	99	2	99	2	99	2
	7	81	81	57	82	51	82	51
	8	88	84	85	83	85	83	85
	9	90	93	100	93	100	93	100
	10	93	99	100	99	100	99	100
	11	94	100	100	100	100	100	100

NOTES: P = Total retention rate.
E = Proportion of population eligible to separate voluntarily.

improvements in civilian airline job prospects. The second is that we may have understated the proportion of officers who were first eligible to leave the Air Force in these later years of service. The higher the proportion first eligible to leave in these years, the lower the total retention.

Table 12

TOTAL NAVIGATOR RETENTION RATES
(Percentages)

FY	Yos	Actual	Assumption 1 P	Assumption 1 E	Assumption 2 P	Assumption 2 E	Assumption 3 P	Assumption 3 E
1977	6	94	94	14	94	14	94	14
	7	88	87	65	87	65	87	65
	8	93	93	80	93	80	93	80
	9	94	93	100	93	100	93	100
	10	97	98	100	98	100	98	100
1978	6	93	96	10	94	15	93	17
	7	87	84	63	85	54	85	57
	8	89	92	90	92	93	92	95
	9	94	93	100	93	100	93	100
	10	95	98	100	98	100	98	100
	11	96	99	100	99	100	99	100
1979	6	95	94	14	94	14	94	14
	7	80	83	66	85	67	86	72
	8	87	86	90	85	90	85	93
	9	89	89	100	89	100	89	100
	10	91	95	100	95	100	95	100
	11	96	97	100	97	100	97	100
1980	6	95	91	19	95	10	95	10
	7	83	82	68	81	68	80	72
	8	91	83	90	83	85	82	90
	9	93	90	100	90	100	91	100
	10	92	93	100	93	100	93	100
	11	95	95	100	95	100	95	100
1981	6	95	91	20	93	15	94	14
	7	83	84	70	82	70	81	70
	8	91	87	90	89	90	88	90
	9	95	92	100	92	100	93	100
	10	95	97	100	97	100	97	100
	11	96	98	100	98	100	98	100

NOTES: P = Total retention rate.
E = Proportion of population eligible to separate voluntarily.

There appear to be no systematic patterns of prediction errors in addition to those discussed above. The period FY 1977 through FY 1981 was one of very large fluctuations in civilian airline hiring prospects for pilots; the promotion opportunities to major, lieutenant colonel, and colonel each increased during the period; and the military received a substantial real pay raise in the last year of the period. The model accounts for these changes fairly well.

X. ANALYSES OF FIVE HYPOTHETICAL COMPENSATION CHANGES

To illustrate some of the capabilities of the dynamic retention model, we have developed five hypothetical changes to the compensation levels and structure in effect from 1973 through 1977. We examine the model's predictions of retention rates given these compensation changes. These predictions are then compared with the retention rates predicted for the same period under the actual, base case compensation system. Because the dynamic retention model allows for the examination of dynamic, disequilibrium (not steady-state) retention rates, not all of the changes are introduced in FY 1973. Some are introduced in later years so that it is possible to examine the effects of unexpected compensation changes introduced after the end of obligation.

The effects of these compensation changes on retention rates are presented for ROTC pilots and nonrated officers. Similar analyses could be conducted for the other sources of commission, for navigators, and for personnel policy changes.

CASE 1: INCREASE IN PAY AND ALLOWANCES

The first compensation change is a real 5 percent increase in basic allowances for quarters and subsistence, after-tax basic pay, and after-tax flight pay. This increase has been introduced in FY 1976 and maintained in FY 1977, and is in addition to any compensation change that occurred in those years. For this illustration, we have also assumed that the increase was completely unexpected before it took place; hence, retention rates in fiscal years before FY 1976 are unaffected by the change.

Table 13 displays the retention rates under the base case and under the changed compensation for those who reached EOB in FY 1976 and who were in the seventh year of service (pilots), sixth year of service (regular, nonrated), or fifth year of service (reserve, nonrated) in FY 1976. Notable about these results is that regulars are proportionally less sensitive to the pay changes than are reserves and that pilots are proportionally less sensitive than nonrated officers.

That pilots are less sensitive than nonrated officers in the dynamic retention model is also evidenced in the response of post-EOB retention rates to the pay change. Table 14 displays the retention rates for nonrated officers who reached EOB in FY 1973. Because the pay increase was unexpected, the first three retention rates in each column are unchanged. The retention rates corresponding to decisions made in FY 1976 and FY 1977 show the small increases in these "career" retention rates due to the unexpected pay increase. The changes in the corresponding pilot retention rates were in the hundredths of percents and therefore are not displayed.

CASE 2: INTRODUCTION OF BONUS

The second compensation change is the introduction of a $10,000 bonus in 1974 and subsequent years for pilots who complete nine years of service and for nonrated officers who complete seven years. We chose those years of service to illustrate the effects on retention rates in earlier and later years of service.

Table 13

ROTC PILOT AND NONRATED RETENTION RATES:
CASE 1, INCREASE ALL PAY ELEMENTS BY 5 PERCENT IN FY 1976
AND FY 1977, FY 1976 END OF OBLIGATION

Year of Service	Regular		Reserve	
	Base Case	Case 1	Base Case	Case 1
Pilots				
7	90	92	56	58
8	93	93	82	83
Cumulative	83	86	46	48
Nonrated				
5	--	--	42	44
6	79	81	84	87
7	95	97	--	--
Cumulative	74	79	36	39

Table 14

ROTC NONRATED RETENTION RATES:
CASE 1, INCREASE ALL PAY ELEMENTS BY 5 PERCENT IN FY 1976
AND FY 1977, FY 1973 END OF OBLIGATION

Year of Service	Regular		Reserve	
	Base Case	Case 1	Base Case	Case 1
5	--	--	42	42
6	90	90	83	83
7	95	95	91	91
8	97	97	→93	→95
9	→98	→ 99	→94	→96
10	→99	→100		
Cumulative	81	82	28	29

Table 15 displays the changes in retention rates for those pilots reaching EOB in FY 1976 and for those reaching EOB in FY 1974. Both fiscal years show the effect on EOB retention of the unexpected bonus. The difference in the response is due, in part, to the fact that civilian airline job opportunities were better in FY 1974 than in FY 1976. Notice the decline in retention in the tenth year of service. Many of those who were induced to remain in the Air Force by the bonus leave after receipt of the bonus.

The nonrated responses to the bonuses are presented in Table 16. Table 16 differs from Table 15 in that FY 1973 EOB retention rates are displayed. The retention rates begin to change in the seventh year of service for regulars and the sixth year for reserves. Where the

Table 15

**ROTC PILOT RETENTION RATES:
CASE 2, $10,000 BONUS BEGINNING IN FY 1974 PAID
AFTER YEAR OF SERVICE 9**

Year of Service	Regular		Reserve	
	Base Case	Case 2	Base Case	Case 2
EOB FY74				
7	78	79	52	53
8	96	98	92	95
9	97	99	94	96
10	97	95	94	90
Cumulative	70	72	42	44
EOB FY76				
7	90	92	56	59
8	93	94	82	85
Cumulative	83	86	46	50

Table 16

**ROTC NONRATED RETENTION RATES:
CASE 2, $10,000 BONUS BEGINNING IN FY 1974 PAID AFTER
YEAR OF SERVICE 7**

Year of Service	Regular		Reserve	
	Base Case	Case 2	Base Case	Case 2
EOB FY73				
5	--	--	42	42
6	90	90	83	89
7	95	98	91	96
8	97	97	93	92
9	98	98	94	93
10	99	99	--	--
Cumulative	81	83	28	31
EOB FY76				
5	--	--	42	45
6	79	81	84	90
7	95	97	--	--
Cumulative	74	79	36	40

retention increase was greatest—among the reserves—the subsequent decline is greatest as well.

CASE 3: RETIREMENT ANNUITY CHANGE

The third compensation change affects the value of the retirement annuity. Currently, the nominal value of a military retirement annuity increases proportionally with the Consumer Price Index (CPI), thus approximately maintaining the real value of the annuity. ("Approximately" because the annuity changes value after discrete intervals of time.) It has been proposed that the retirement annuity increase instead with whichever increases by less, the CPI or the level of active duty pay.

We wish to isolate the effects of this prospective decline in the real value of retirement annuities from the effects of fluctuating real values of military pay to understand the effects of retirement benefit changes on retention. To that end we (1) recorded the minimum of the percentage increases in the CPI and the nominal level of active duty pay for each year from 1971 through 1981 and (2) calculated what would happen to the real value of a retirement annuity if the rule above were used to change the nominal value of the annuity. The results of these calculations are shown in Table 17.

The change introduced to the retirement system in Case 3, then, is that the factors shown in col. (d) of Table 17 are used to reduce the real value of the retirement annuity. The first year the individual is out of the military, his retirement annuity does not decline in real value. The second year it declines to 98 percent of its initial real value; the third year it declines to 92 percent, and by the tenth year the retirement annuity is worth 81 percent of its initial real value. The rate of decline from 1981 to 1991 and each ten year period thereafter is assumed to be the same as from 1971 to 1981. It is assumed that officers currently on active duty expect

Table 17

BACKGROUND FOR CASE 3

(1971 base year; percent)

Year	CPI Increase	Nominal Pay Increase	Lesser of (a) or (b)	Real Value of the Retirement Annuity
	(a)	(b)	(c)	(d)
1972	3.4	14.4	3.4	100
1973	8.8	6.2	6.2	98
1974	12.2	5.5	5.5	92
1975	7.0	5.0	5.0	90
1976	4.8	3.6	3.6	89
1977	6.8	7.1	6.8	89
1978	9.0	5.5	5.5	86
1979	13.4	7.0	7.0	81
1980	12.5	11.7	11.7	81
1981	8.7	14.3	8.7	81

SOURCE: AF/MPXA.

this pattern of decline in the real value of the retirement annuity to happen to them when they retire. This change to the retirement system is introduced before FY 1973. Tables 18 and 19 display the retention rates of pilots and nonrated officers who fully anticipate the change. The small response among pilots is consistent with their relative insensitivity to pay changes and the fact that retirement pay is a smaller proportion of their total compensation than it is for nonrated officers. That nonrated regular retention rates are more sensitive to the change than reserves is because even in the base case reserves have small probability of reaching retirement. Therefore, a given change in the retirement annuity translates to a smaller change in the cost of leaving for a reserve officer than for a regular.

CASE 4: INCREASE IN FLIGHT PAY

In the fourth case we increase the level of flight pay by 25 percent. The increase is effective in FY 1977 and is unexpected before that year. Table 20 presents the retention changes due to the flight pay change among those who were surprised by the flight pay increase after making their EOB retention decisions and among those who make their EOB decision knowing of the change. Since the flight pay change is a smaller proportional change in pay than the 5 percent total pay change of Case 1, the relative insensitivity of pilot retention rates to the flight pay change is not surprising.

Table 18

ROTC PILOT RETENTION RATES:
CASE 3, MODIFIED RETIREMENT ANNUITY, ANNUAL INCREASE
SMALLER OF CPI OR PAY INCREASE

Year of Service	Regular		Reserve	
	Base Case	Case 3	Base Case	Case 3
EOB FY73				
6	77	77	51	51
7	93	93	88	87
8	99	98	97	96
9	99	99	98	98
10	99	99	98	97
Cumulative	69	68	41	40
EOB FY76				
7	90	89	56	55
8	93	93	82	82
Cumulative	83	82	46	45

Table 19

ROTC NONRATED RETENTION RATES:
CASE 3, MODIFIED RETIREMENT ANNUITY, ANNUAL INCREASE
SMALLER OF CPI OR PAY INCREASE

Year of Service	Regular		Reserve	
	Base Case	Case 3	Base Case	Case 3
EOB FY73				
5	--	--	42	41
6	90	86	83	82
7	95	91	91	89
8	97	94	93	91
9	98	96	94	93
10	99	97	--	--
Cumulative	81	69	28	25
EOB FY76				
5	--	--	42	42
6	79	76	84	83
7	95	91	--	--
Cumulative	74	69	36	34

Table 20

ROTC PILOT RETENTION RATES:
CASE 4, 25 PERCENT INCREASE IN FY 1977 FLIGHT PAY

Year of Service	Regular		Reserve	
	Base Case	Case 4	Base Case	Case 4
EOB FY76				
7	90	90	56	56
8	93	93	82	83
Cumulative	83	84	46	46
EOB FY77				
7	91	92	52	53

CASE 5: INDEXING PAY TO THE CPI

Finally, we consider what retention rates would have been had the real level of military pay in FY 1973 been maintained in subsequent years. In Case 5 we assume that active duty pay—including basic pay, allowances, and flight pay—increases in nominal value in proportion to the CPI. Table 21 shows the effects of this change on pilot retention rates for those who reach EOB in FY 1973 and FY 1977. Table 22 displays the effects on nonrated retention for the same groups. The EOB retention rate in FY 1973 does not change because the FY 1973 compensation level was not changed and we assumed in the base case that the individual expected real compensation levels in the military and the civilian sector to remain constant in the future.

Table 21

ROTC PILOT RETENTION RATES:
CASE 5, PAY CONSTANT IN REAL TERMS BEGINNING IN FY 1973

Year of Service	Regular		Reserve	
	Base Case	Case 5	Base Case	Case 5
EOB FY73				
6	77	77	51	51
7	93	94	88	89
8	99	100	97	98
9	99	100	98	98
10	99	100	98	98
Cumulative	69	72	41	43
EOB FY76				
7	90	96	56	61
8	93	97	82	86
Cumulative	83	92	46	52

Table 22

ROTC NONRATED RETENTION RATES:
CASE 5, PAY CONSTANT IN REAL TERMS BEGINNING IN FY 1973

Year of Service	Regular		Reserve	
	Base Case	Case 5	Base Case	Case 5
EOB FY73				
5	--	--	42	42
6	90	90	83	88
7	95	98	91	96
8	97	100	93	97
9	98	100	94	98
10	99	100	--	--
Cumulative	81	88	28	34
EOB FY76				
5	--	--	42	47
6	79	83	84	91
7	95	98	--	--
Cumulative	74	82	36	43

XI. CONCLUSIONS

The dynamic retention model describes the decisionmaking process of officers making stay/leave decisions over time in an uncertain environment, which allows it to make retention predictions for policy changes that have no historical analogues. The model can analyze the effects on retention of a broad range of compensation, retirement, and personnel policies. Included in the personnel policy changes are changes in promotion rates, regular force integration rates, and changes in the timing of mandatory separation or retirement (high years of tenure). The personnel policy changes may be examined singly or in combination with other changes. For example, proposed retirement system changes might contain changes not only in the amounts and timing of retirement annuities but also in the timing of mandatory retirement.

The dynamic retention model resolves several problems and logical inconsistencies that attend other retention models currently used in the Department of Defense such as the ACOL and PVCOL models. First, the model incorporates a rich picture of officers' military futures. It can accommodate changes in promotion opportunity, promotion timing, and high years of tenure within its input parameters. Second, recognizing persistent differences among officers gives rise to "backward-looking" retention rates. That is, the retention rate for each yeargroup of officers at each year of service depends on who is there to be making a decision, which in turn depends on the history of compensation and personnel policies affecting that yeargroup. Third, the model recognizes that officers cannot be certain when they will ultimately leave the military; they thus value flexibility. Policies that restrict flexibility are predicted to reduce retention rates.

Comparison of the predictions of the dynamic retention model with the ACOL and PVCOL models demonstrates the biases and substantial errors in the predictions of these latter models. Including a year of service term improves the fit of the ACOL model but does not resolve the logical inconsistencies inherent in that model.

The dynamic retention model's ability to evaluate such a broad range of policy changes exacts a cost: It requires more data than simpler models. The parameters of the dynamic retention model were estimated with empirical data from the period 1973–1977, and it would be desirable to reestimate the parameters periodically with more recent data. However, that would require generating longitudinal files on officers on a regular basis—i.e., successive observations on each officer that would permit development of career histories such as those found in the appendix. The files should contain information on officers' initial active duty service commitment dates, selection dates for regular commissioning,[1] and promotion histories. Additional model validation would also be desirable. Fortunately, model validation requires group rather than individual information: rates of promotion and selection for regular commission by source of commission, component (for promotions), rating, and year of service.

[1]It is important to know each officer's opportunities; selection dates carry this information. Even if an officer turns down a regular commission, he has the opportunities of a regular officer at the time he makes his decision. Also, until recently non-rated officers receiving regular commissions were obliged to remain in the Air Force at least until completing five years of service. Accurate prediction of retention rates in the fourth and fifth years of service requires identification of those selected for regular commissions at completion of their fourth year of service. Special data processing was required to generate these data for estimation of the model parameters, but similar data were not readily available for our model validation. Retroactive updating of individual records to indicate regular commissioning "next year" would be one way to solve this problem.

There are two directions in which future research should progress. The dynamic retention model, as it stands, is a useful tool for the classes of policy analysis discussed above. Extensive use of the model requires development of software for routinely updating its parameters and for simulation. For other analyses, however, a richer set of tools is desirable. Problems that require the examination of alternative policies to achieve a specified personnel force structure require the integration of the retention model with a dynamic inventory projection model.[2]

A second direction for research is a more complete modeling of the life cycles of military careers. In the dynamic retention model the individual's purposeful response to policy is explicit. The model does not begin with the accession decision, nor does it recognize that not only do personnel respond to policy, but military policies respond to the collective behavior of personnel. For example, a reduction in the retention rate of captains today may induce an increase in the promotion rate to major in the future. Captains may anticipate this future change in the promotion rate and may cause the decline in retention to be smaller than if the promotion rate increase was not anticipated. Modeling of the interplay among personnel decisions and the interplay between policy and behavior should yield more accurate assessments of the effects of various personnel and compensation policies.

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[2]A dynamic inventory projection model takes an initial inventory of officers—described by aeronautical rating, component, grade, year of service, and other demographic characteristics—and ages, separates, and accesses officers. The key parameters in the model are the total retention rates discussed in Sec. IX.

Appendix

SAMPLE PERIOD EVENTS

1973	PIL	ACAD	7YOS	STAY	2					3
1973	PIL	ACAD	7YOS	STAY	2	2				3
1973	PIL	ACAD	7YOS	STAY	2	2	2	2	2	78
1973	PIL	ACAD	7YOS	STAY	2	2	2	13	13	4
1973	PIL	ACAD	7YOS	STAY	2	2	2			1
1973	PIL	ACAD	7YOS	LEAVE	2	2	2			3
1973	PIL	ACAD	7YOS	LEAVE	2	2	2	2		2
1973	PIL	ACAD	7YOS	LEAVE	2	2	2	2	2	4
1973	PIL	ACAD	7YOS	LEAVE	2					41
1973	PIL	ACAD	7YOS	LEAVE	2	2				5
1973	PIL	ACAD	8YOS	STAY	2					2
1973	PIL	ACAD	8YOS	STAY	2	2	2	2	2	65
1973	PIL	ACAD	8YOS	STAY	2	2	2	2	15	2
1973	PIL	ACAD	8YOS	STAY	2	2	2	14	14	4
1973	PIL	ACAD	8YOS	STAY	2	2	13	13	13	3
1973	PIL	ACAD	8YOS	LEAVE	2					9
1973	PIL	ACAD	8YOS	LEAVE	2	2				2
1973	PIL	ACAD	8YOS	LEAVE	2	2	2			1
1973	PIL	ACAD	9YOS	STAY	2	2				1
1973	PIL	ACAD	9YOS	STAY	2	2	2			1
1973	PIL	ACAD	9YOS	STAY	2	2	2	2		1
1973	PIL	ACAD	9YOS	STAY	2	2	2	2	2	4
1973	PIL	ACAD	9YOS	STAY	2	2	2	2	16	37
1973	PIL	ACAD	9YOS	STAY	2	2	2	15	15	2
1973	PIL	ACAD	9YOS	STAY	2	2	14	14	14	1
1973	PIL	ACAD	9YOS	STAY	2	13	13	13	13	1
1973	PIL	ACAD	9YOS	STAY	2	13	13	13	31	1
1973	PIL	ACAD	9YOS	LEAVE	2	2	2	2	2	1
1973	PIL	ACAD	9YOS	LEAVE	2					7
1973	PIL	ACAD	9YOS	LEAVE	2	2				1
1973	PIL	ACAD	9YOS	LEAVE	2	2	2			1
1973	PIL	ACAD	9YOS	LEAVE	2	2	2	2		1
1974	PIL	ACAD	7YOS	STAY	2					2
1974	PIL	ACAD	7YOS	STAY	2	2				10
1974	PIL	ACAD	7YOS	STAY	2	2	2	2		114
1974	PIL	ACAD	7YOS	STAY	2	2	2	13		5
1974	PIL	ACAD	7YOS	LEAVE	2					67
1974	PIL	ACAD	7YOS	LEAVE	2	2				5
1974	PIL	ACAD	7YOS	LEAVE	2	2	2	2		2
1974	PIL	ACAD	8YOS	STAY	2					2
1974	PIL	ACAD	8YOS	STAY	2	2	2	2		60
1974	PIL	ACAD	8YOS	STAY	2	2	2	14		3
1974	PIL	ACAD	8YOS	STAY	2	2	13	13		4
1974	PIL	ACAD	8YOS	LEAVE	2					13
1974	PIL	ACAD	8YOS	LEAVE	2	2				2
1974	PIL	ACAD	8YOS	LEAVE	2	2	2			1
1974	PIL	ACAD	8YOS	LEAVE	2	2	2	2		2
1974	PIL	ACAD	9YOS	STAY	2					1
1974	PIL	ACAD	9YOS	STAY	2	2	2	2		33
1974	PIL	ACAD	9YOS	STAY	2	2	14	14		1
1974	PIL	ACAD	9YOS	STAY	2	13	13	13		5
1974	PIL	ACAD	9YOS	LEAVE	2					5

1974	PIL	ACAD	9YOS	LEAVE	2	2				1
1974	PIL	ACAD	9YOS	LEAVE	2	2	2	2		1
1975	PIL	ACAD	7YOS	STAY	2	2	2			160
1975	PIL	ACAD	7YOS	STAY	2	2				3
1975	PIL	ACAD	7YOS	LEAVE	2					83
1975	PIL	ACAD	7YOS	LEAVE	2	2				5
1975	PIL	ACAD	7YOS	LEAVE	2	2	2			6
1975	PIL	ACAD	8YOS	STAY	2	2	2			79
1975	PIL	ACAD	8YOS	STAY	2	2	13			4
1975	PIL	ACAD	8YOS	STAY	2					3
1975	PIL	ACAD	8YOS	LEAVE	2	2	2			1
1975	PIL	ACAD	8YOS	LEAVE	2					10
1975	PIL	ACAD	8YOS	LEAVE	2	2				3
1975	PIL	ACAD	9YOS	STAY	2	2	14			1
1975	PIL	ACAD	9YOS	STAY	2	2	2			33
1975	PIL	ACAD	9YOS	STAY	2	13	13			3
1975	PIL	ACAD	9YOS	LEAVE	2					4
1975	PIL	ACAD	9YOS	LEAVE	2	2	2			2
1976	PIL	ACAD	7YOS	STAY	2	2				57
1976	PIL	ACAD	7YOS	STAY	2					2
1976	PIL	ACAD	7YOS	LEAVE	2	2				3
1976	PIL	ACAD	7YOS	LEAVE	2					9
1976	PIL	ACAD	8YOS	STAY	2					5
1976	PIL	ACAD	8YOS	STAY	2	2				102
1976	PIL	ACAD	8YOS	LEAVE	2					14
1976	PIL	ACAD	8YOS	LEAVE	2	2				2
1976	PIL	ACAD	9YOS	STAY	2					4
1976	PIL	ACAD	9YOS	STAY	2	2				36
1976	PIL	ACAD	9YOS	LEAVE	2	2				4
1976	PIL	ACAD	9YOS	LEAVE	2					6
1977	PIL	ACAD	7YOS	STAY	2					94
1977	PIL	ACAD	7YOS	LEAVE	2					9
1977	PIL	ACAD	8YOS	STAY	2					207
1977	PIL	ACAD	8YOS	LEAVE	2					74
1977	PIL	ACAD	9YOS	STAY	2					32
1977	PIL	ACAD	9YOS	LEAVE	2					4
1973	PIL	ROTC	6YOS	STAY	1					1
1973	PIL	ROTC	6YOS	STAY	1	1				4
1973	PIL	ROTC	6YOS	STAY	1	1	1			2
1973	PIL	ROTC	6YOS	STAY	1	1	1	1		4
1973	PIL	ROTC	6YOS	STAY	1	1	1	1	1	94
1973	PIL	ROTC	6YOS	STAY	1	1	1	1	2	6
1973	PIL	ROTC	6YOS	STAY	1	1	1	2	2	1
1973	PIL	ROTC	6YOS	STAY	1	2	2	2	2	5
1973	PIL	ROTC	6YOS	STAY	2	2				2
1973	PIL	ROTC	6YOS	STAY	2	2	2			4
1973	PIL	ROTC	6YOS	STAY	2	2	2	2		1
1973	PIL	ROTC	6YOS	STAY	2	2	2	2	2	242
1973	PIL	ROTC	6YOS	STAY	2	2	2	2	13	1
1973	PIL	ROTC	6YOS	LEAVE	1					281
1973	PIL	ROTC	6YOS	LEAVE	1	1				15
1973	PIL	ROTC	6YOS	LEAVE	1	1	1			16
1973	PIL	ROTC	6YOS	LEAVE	1	1	1	1		7
1973	PIL	ROTC	6YOS	LEAVE	1	1	1	1	1	3
1973	PIL	ROTC	6YOS	LEAVE	1	2	2	2		1
1973	PIL	ROTC	6YOS	LEAVE	2					85
1973	PIL	ROTC	6YOS	LEAVE	2	2				12
1973	PIL	ROTC	6YOS	LEAVE	2	2	2			11
1973	PIL	ROTC	6YOS	LEAVE	2	2	2	2		6
1973	PIL	ROTC	6YOS	LEAVE	2	2	2	2	2	9
1973	PIL	ROTC	7YOS	STAY	1					1

1973	PIL	ROTC	7YOS	STAY	1	1				2
1973	PIL	ROTC	7YOS	STAY	1	1	1	1		6
1973	PIL	ROTC	7YOS	STAY	1	1	1	1	1	31
1973	PIL	ROTC	7YOS	STAY	1	1	1	2	2	3
1973	PIL	ROTC	7YOS	STAY	1	1	2	2	2	1
1973	PIL	ROTC	7YOS	STAY	2	2				4
1973	PIL	ROTC	7YOS	STAY	2	2	2	2		1
1973	PIL	ROTC	7YOS	STAY	2	2	2	2	2	270
1973	PIL	ROTC	7YOS	STAY	2	2	2	2	14	8
1973	PIL	ROTC	7YOS	STAY	2	2	2	13	13	5
1973	PIL	ROTC	7YOS	STAY	2	2	12	12	12	1
1973	PIL	ROTC	7YOS	STAY	2					5
1973	PIL	ROTC	7YOS	LEAVE	1					44
1973	PIL	ROTC	7YOS	LEAVE	1	1				7
1973	PIL	ROTC	7YOS	LEAVE	1	1	1			1
1973	PIL	ROTC	7YOS	LEAVE	1	1	1	1	1	1
1973	PIL	ROTC	7YOS	LEAVE	2					57
1973	PIL	ROTC	7YOS	LEAVE	2	2				15
1973	PIL	ROTC	7YOS	LEAVE	2	2	2			5
1973	PIL	ROTC	7YOS	LEAVE	2	2	2	2		4
1973	PIL	ROTC	7YOS	LEAVE	2	2	2	2	2	12
1973	PIL	ROTC	8YOS	STAY	1	1				1
1973	PIL	ROTC	8YOS	STAY	1	1	1	1	1	1
1973	PIL	ROTC	8YOS	STAY	2	2	2	2	2	23
1973	PIL	ROTC	8YOS	STAY	2	2	2	2	15	22
1973	PIL	ROTC	8YOS	LEAVE	1					1
1973	PIL	ROTC	8YOS	LEAVE	1	1				1
1973	PIL	ROTC	8YOS	LEAVE	2					4
1973	PIL	ROTC	8YOS	LEAVE	2	2				3
1973	PIL	ROTC	8YOS	LEAVE	2	2	2	2	2	1
1974	PIL	ROTC	6YOS	STAY	1					7
1974	PIL	ROTC	6YOS	STAY	1	1				1
1974	PIL	ROTC	6YOS	STAY	1	1	1	1		120
1974	PIL	ROTC	6YOS	STAY	1	1	1	2		9
1974	PIL	ROTC	6YOS	STAY	1	2	2	2		23
1974	PIL	ROTC	6YOS	STAY	2					2
1974	PIL	ROTC	6YOS	STAY	2	2				4
1974	PIL	ROTC	6YOS	STAY	2	2	2			2
1974	PIL	ROTC	6YOS	STAY	2	2	2	2		178
1974	PIL	ROTC	6YOS	STAY	2	2	2	12		2
1974	PIL	ROTC	6YOS	LEAVE	1					322
1974	PIL	ROTC	6YOS	LEAVE	1	1				11
1974	PIL	ROTC	6YOS	LEAVE	1	1	1			8
1974	PIL	ROTC	6YOS	LEAVE	1	1	1	1		7
1974	PIL	ROTC	6YOS	LEAVE	1	1	2	2		1
1974	PIL	ROTC	6YOS	LEAVE	2					75
1974	PIL	ROTC	6YOS	LEAVE	2	2				3
1974	PIL	ROTC	6YOS	LEAVE	2	2	2			3
1974	PIL	ROTC	6YOS	LEAVE	2	2	2	2		5
1974	PIL	ROTC	7YOS	STAY	1					2
1974	PIL	ROTC	7YOS	STAY	1	1	1	1		59
1974	PIL	ROTC	7YOS	STAY	1	1	1	2		4
1974	PIL	ROTC	7YOS	STAY	1	1	2	2		4
1974	PIL	ROTC	7YOS	STAY	2					6
1974	PIL	ROTC	7YOS	STAY	2	2				3
1974	PIL	ROTC	7YOS	STAY	2	2	2			2
1974	PIL	ROTC	7YOS	STAY	2	2	2	2		265
1974	PIL	ROTC	7YOS	STAY	2	2	2	13		4
1974	PIL	ROTC	7YOS	STAY	2	2	12	12		3
1974	PIL	ROTC	7YOS	LEAVE	1					50
1974	PIL	ROTC	7YOS	LEAVE	1	1				2

1974	PIL	ROTC	7YOS	LEAVE	1	1	1		1
1974	PIL	ROTC	7YOS	LEAVE	1	1	1	1	3
1974	PIL	ROTC	7YOS	LEAVE	2				52
1974	PIL	ROTC	7YOS	LEAVE	2	2			8
1974	PIL	ROTC	7YOS	LEAVE	2	2	2		7
1974	PIL	ROTC	7YOS	LEAVE	2	2	2	2	9
1974	PIL	ROTC	8YOS	STAY	1				5
1974	PIL	ROTC	8YOS	STAY	1	1	1	1	8
1974	PIL	ROTC	8YOS	STAY	1	1	2	2	1
1974	PIL	ROTC	8YOS	STAY	2				2
1974	PIL	ROTC	8YOS	STAY	2	2	2	2	42
1974	PIL	ROTC	8YOS	STAY	2	2	13	13	1
1974	PIL	ROTC	8YOS	LEAVE	1	1	1		1
1974	PIL	ROTC	8YOS	LEAVE	1				16
1974	PIL	ROTC	8YOS	LEAVE	2				16
1974	PIL	ROTC	8YOS	LEAVE	2	2			1
1975	PIL	ROTC	6YOS	STAY	1				6
1975	PIL	ROTC	6YOS	STAY	1	1			1
1975	PIL	ROTC	6YOS	STAY	1	1	1		130
1975	PIL	ROTC	6YOS	STAY	1	1	2		4
1975	PIL	ROTC	6YOS	STAY	1	2	2		14
1975	PIL	ROTC	6YOS	STAY	2	2			7
1975	PIL	ROTC	6YOS	STAY	2	2	2		139
1975	PIL	ROTC	6YOS	STAY	2				1
1975	PIL	ROTC	6YOS	LEAVE	1				178
1975	PIL	ROTC	6YOS	LEAVE	1	1	1		8
1975	PIL	ROTC	6YOS	LEAVE	1	1			11
1975	PIL	ROTC	6YOS	LEAVE	2				36
1975	PIL	ROTC	6YOS	LEAVE	2	2			4
1975	PIL	ROTC	6YOS	LEAVE	2	2	2		5
1975	PIL	ROTC	7YOS	STAY	1				6
1975	PIL	ROTC	7YOS	STAY	1	1			3
1975	PIL	ROTC	7YOS	STAY	1	1	1		78
1975	PIL	ROTC	7YOS	STAY	1	1	2		10
1975	PIL	ROTC	7YOS	STAY	2				2
1975	PIL	ROTC	7YOS	STAY	2	2			2
1975	PIL	ROTC	7YOS	STAY	2	2	2		222
1975	PIL	ROTC	7YOS	STAY	2	2	12		1
1975	PIL	ROTC	7YOS	LEAVE	1				56
1975	PIL	ROTC	7YOS	LEAVE	1	1	1		5
1975	PIL	ROTC	7YOS	LEAVE	1	1			6
1975	PIL	ROTC	7YOS	LEAVE	2	2			5
1975	PIL	ROTC	7YOS	LEAVE	2	2	2		13
1975	PIL	ROTC	7YOS	LEAVE	2				26
1975	PIL	ROTC	8YOS	STAY	1	1	1		13
1975	PIL	ROTC	8YOS	STAY	2	2	2		25
1975	PIL	ROTC	8YOS	STAY	2	2	13		1
1975	PIL	ROTC	8YOS	STAY	2				1
1975	PIL	ROTC	8YOS	LEAVE	1				14
1975	PIL	ROTC	8YOS	LEAVE	2	2	2		3
1975	PIL	ROTC	8YOS	LEAVE	2	2			2
1975	PIL	ROTC	8YOS	LEAVE	2				3
1976	PIL	ROTC	6YOS	STAY	1	2			1
1976	PIL	ROTC	6YOS	STAY	1	1			2
1976	PIL	ROTC	6YOS	STAY	2	2			10
1976	PIL	ROTC	6YOS	LEAVE	1				6
1976	PIL	ROTC	6YOS	LEAVE	2				3
1976	PIL	ROTC	7YOS	STAY	1				6
1976	PIL	ROTC	7YOS	STAY	1	1			101
1976	PIL	ROTC	7YOS	STAY	1	2			2
1976	PIL	ROTC	7YOS	STAY	2	2			202

1976	PIL	ROTC	7YOS	STAY	2					2
1976	PIL	ROTC	7YOS	LEAVE	1	1				17
1976	PIL	ROTC	7YOS	LEAVE	1					80
1976	PIL	ROTC	7YOS	LEAVE	2					27
1976	PIL	ROTC	7YOS	LEAVE	2	2				7
1976	PIL	ROTC	8YOS	STAY	1					1
1976	PIL	ROTC	8YOS	STAY	1	1				16
1976	PIL	ROTC	8YOS	STAY	1	2				2
1976	PIL	ROTC	8YOS	STAY	2	2				26
1976	PIL	ROTC	8YOS	STAY	2					1
1976	PIL	ROTC	8YOS	LEAVE	1					11
1976	PIL	ROTC	8YOS	LEAVE	2					4
1977	PIL	ROTC	6YOS	STAY	1					23
1977	PIL	ROTC	6YOS	STAY	2					12
1977	PIL	ROTC	6YOS	LEAVE	1					27
1977	PIL	ROTC	6YOS	LEAVE	2					1
1977	PIL	ROTC	7YOS	STAY	1					363
1977	PIL	ROTC	7YOS	STAY	2					384
1977	PIL	ROTC	7YOS	LEAVE	1					353
1977	PIL	ROTC	7YOS	LEAVE	2					54
1977	PIL	ROTC	8YOS	STAY	1					43
1977	PIL	ROTC	8YOS	STAY	2					69
1977	PIL	ROTC	8YOS	LEAVE	1					38
1977	PIL	ROTC	8YOS	LEAVE	2					19
1973	PIL	OTS	6YOS	STAY	1					4
1973	PIL	OTS	6YOS	STAY	1	1				2
1973	PIL	OTS	6YOS	STAY	1	1	1			1
1973	PIL	OTS	6YOS	STAY	1	1	1	1		1
1973	PIL	OTS	6YOS	STAY	1	1	1	1	1	92
1973	PIL	OTS	6YOS	STAY	1	1	1	1	2	5
1973	PIL	OTS	6YOS	STAY	1	1	1	2	2	5
1973	PIL	OTS	6YOS	STAY	1	1	2	2	2	3
1973	PIL	OTS	6YOS	STAY	1	2	2	2	2	5
1973	PIL	OTS	6YOS	STAY	2	2				6
1973	PIL	OTS	6YOS	STAY	2	2	2			3
1973	PIL	OTS	6YOS	STAY	2	2	2	2		1
1973	PIL	OTS	6YOS	STAY	2	2	2	2	2	164
1973	PIL	OTS	6YOS	STAY	2	2	2	2	13	1
1973	PIL	OTS	6YOS	LEAVE	1					405
1973	PIL	OTS	6YOS	LEAVE	1	1				8
1973	PIL	OTS	6YOS	LEAVE	1	1	1			10
1973	PIL	OTS	6YOS	LEAVE	1	1	1	1		7
1973	PIL	OTS	6YOS	LEAVE	1	1	1	1	1	3
1973	PIL	OTS	6YOS	LEAVE	2					101
1973	PIL	OTS	6YOS	LEAVE	2	2				10
1973	PIL	OTS	6YOS	LEAVE	2	2	2			5
1973	PIL	OTS	6YOS	LEAVE	2	2	2	2		7
1973	PIL	OTS	6YOS	LEAVE	2	2	2	2	2	11
1973	PIL	OTS	7YOS	STAY	1					2
1973	PIL	OTS	7YOS	STAY	1	1				3
1973	PIL	OTS	7YOS	STAY	1	1	1	1		2
1973	PIL	OTS	7YOS	STAY	1	1	1	1	1	29
1973	PIL	OTS	7YOS	STAY	1	1	1	1	2	1
1973	PIL	OTS	7YOS	STAY	1	1	1	2	2	2
1973	PIL	OTS	7YOS	STAY	1	1	2	2	2	2
1973	PIL	OTS	7YOS	STAY	2					2
1973	PIL	OTS	7YOS	STAY	2	2				2
1973	PIL	OTS	7YOS	STAY	2	2	2	2	2	169
1973	PIL	OTS	7YOS	STAY	2	2	2	2	14	1
1973	PIL	OTS	7YOS	STAY	2	2	2	13	13	1
1973	PIL	OTS	7YOS	LEAVE	1					117

1973	PIL	OTS	7YOS	LEAVE	1	1				5
1973	PIL	OTS	7YOS	LEAVE	1	1	1			1
1973	PIL	OTS	7YOS	LEAVE	1	1	1	1		2
1973	PIL	OTS	7YOS	LEAVE	2					52
1973	PIL	OTS	7YOS	LEAVE	2	2				10
1973	PIL	OTS	7YOS	LEAVE	2	2	2			1
1973	PIL	OTS	7YOS	LEAVE	2	2	2	2		7
1973	PIL	OTS	7YOS	LEAVE	2	2	2	2	2	5
1973	PIL	OTS	8YOS	STAY	1	1				1
1973	PIL	OTS	8YOS	STAY	2					1
1973	PIL	OTS	8YOS	STAY	2	2	2	2	2	11
1973	PIL	OTS	8YOS	STAY	2	2	2	2	15	7
1973	PIL	OTS	8YOS	LEAVE	1					4
1973	PIL	OTS	8YOS	LEAVE	1	1	1	1		1
1973	PIL	OTS	8YOS	LEAVE	2					8
1973	PIL	OTS	8YOS	LEAVE	2	2				1
1974	PIL	OTS	6YOS	STAY	1					14
1974	PIL	OTS	6YOS	STAY	1	1				1
1974	PIL	OTS	6YOS	STAY	1	1	1			4
1974	PIL	OTS	6YOS	STAY	1	1	1	1		146
1974	PIL	OTS	6YOS	STAY	1	1	1	2		11
1974	PIL	OTS	6YOS	STAY	1	2	2			1
1974	PIL	OTS	6YOS	STAY	1	2	2	2		27
1974	PIL	OTS	6YOS	STAY	2					2
1974	PIL	OTS	6YOS	STAY	2	2				3
1974	PIL	OTS	6YOS	STAY	2	2	2	2		139
1974	PIL	OTS	6YOS	STAY	2	2	11	11		1
1974	PIL	OTS	6YOS	LEAVE	1					649
1974	PIL	OTS	6YOS	LEAVE	1	1				29
1974	PIL	OTS	6YOS	LEAVE	1	1	1			11
1974	PIL	OTS	6YOS	LEAVE	1	1	1	1		16
1974	PIL	OTS	6YOS	LEAVE	1	2	2			2
1974	PIL	OTS	6YOS	LEAVE	2					89
1974	PIL	OTS	6YOS	LEAVE	2	2				7
1974	PIL	OTS	6YOS	LEAVE	2	2	2			6
1974	PIL	OTS	6YOS	LEAVE	2	2	2	2		5
1974	PIL	OTS	7YOS	STAY	1					1
1974	PIL	OTS	7YOS	STAY	1	1	1			1
1974	PIL	OTS	7YOS	STAY	1	1	1	1		75
1974	PIL	OTS	7YOS	STAY	1	1	1	2		3
1974	PIL	OTS	7YOS	STAY	1	1	2	2		2
1974	PIL	OTS	7YOS	STAY	2					2
1974	PIL	OTS	7YOS	STAY	2	2				3
1974	PIL	OTS	7YOS	STAY	2	2	2	2		176
1974	PIL	OTS	7YOS	LEAVE	1	1				6
1974	PIL	OTS	7YOS	LEAVE	1					97
1974	PIL	OTS	7YOS	LEAVE	1	1	1			3
1974	PIL	OTS	7YOS	LEAVE	1	1	1	1		1
1974	PIL	OTS	7YOS	LEAVE	2					46
1974	PIL	OTS	7YOS	LEAVE	2	2				4
1974	PIL	OTS	7YOS	LEAVE	2	2	2			3
1974	PIL	OTS	7YOS	LEAVE	2	2	2	2		6
1974	PIL	OTS	8YOS	STAY	1	1	1			2
1974	PIL	OTS	8YOS	STAY	1					1
1974	PIL	OTS	8YOS	STAY	1	1	1	1		13
1974	PIL	OTS	8YOS	STAY	1	1	2	2		1
1974	PIL	OTS	8YOS	STAY	2	2	2	2		31
1974	PIL	OTS	8YOS	LEAVE	1					19
1974	PIL	OTS	8YOS	LEAVE	1	1	1	1		2
1974	PIL	OTS	8YOS	LEAVE	2					9
1975	PIL	OTS	6YOS	STAY	1	1	2			5

1975	PIL	OTS	6YOS	STAY	1			6
1975	PIL	OTS	6YOS	STAY	1	1		5
1975	PIL	OTS	6YOS	STAY	1	1	1	172
1975	PIL	OTS	6YOS	STAY	1	2	2	14
1975	PIL	OTS	6YOS	STAY	2	2		1
1975	PIL	OTS	6YOS	STAY	2	2	11	1
1975	PIL	OTS	6YOS	STAY	2			1
1975	PIL	OTS	6YOS	STAY	2	2	2	136
1975	PIL	OTS	6YOS	LEAVE	1	1		13
1975	PIL	OTS	6YOS	LEAVE	1	1	1	23
1975	PIL	OTS	6YOS	LEAVE	1			237
1975	PIL	OTS	6YOS	LEAVE	2			46
1975	PIL	OTS	6YOS	LEAVE	2	2	2	2
1975	PIL	OTS	6YOS	LEAVE	2	2		4
1975	PIL	OTS	7YOS	STAY	1			6
1975	PIL	OTS	7YOS	STAY	1	1	2	7
1975	PIL	OTS	7YOS	STAY	1	1		1
1975	PIL	OTS	7YOS	STAY	1	1	1	103
1975	PIL	OTS	7YOS	STAY	2			3
1975	PIL	OTS	7YOS	STAY	2	2	2	225
1975	PIL	OTS	7YOS	STAY	2	2		4
1975	PIL	OTS	7YOS	LEAVE	1	1	1	9
1975	PIL	OTS	7YOS	LEAVE	1	1		8
1975	PIL	OTS	7YOS	LEAVE	1			98
1975	PIL	OTS	7YOS	LEAVE	2	2	2	11
1975	PIL	OTS	7YOS	LEAVE	2			20
1975	PIL	OTS	7YOS	LEAVE	2	2		7
1975	PIL	OTS	8YOS	STAY	1	1	2	2
1975	PIL	OTS	8YOS	STAY	1	1	1	11
1975	PIL	OTS	8YOS	STAY	2	2	2	28
1975	PIL	OTS	8YOS	STAY	2			1
1975	PIL	OTS	8YOS	LEAVE	1			17
1975	PIL	OTS	8YOS	LEAVE	2			13
1975	PIL	OTS	8YOS	LEAVE	2	2		2
1976	PIL	OTS	6YOS	STAY	1	2		1
1976	PIL	OTS	6YOS	STAY	1			1
1976	PIL	OTS	6YOS	STAY	1	1		8
1976	PIL	OTS	6YOS	STAY	2	2		2
1976	PIL	OTS	6YOS	LEAVE	1			8
1976	PIL	OTS	6YOS	LEAVE	1	1		2
1976	PIL	OTS	6YOS	LEAVE	2			1
1976	PIL	OTS	7YOS	STAY	1	1		275
1976	PIL	OTS	7YOS	STAY	1			20
1976	PIL	OTS	7YOS	STAY	1	2		6
1976	PIL	OTS	7YOS	STAY	2			5
1976	PIL	OTS	7YOS	STAY	2	2		277
1976	PIL	OTS	7YOS	LEAVE	1			349
1976	PIL	OTS	7YOS	LEAVE	1	1		34
1976	PIL	OTS	7YOS	LEAVE	2	2		28
1976	PIL	OTS	7YOS	LEAVE	2			51
1976	PIL	OTS	8YOS	STAY	1	1		23
1976	PIL	OTS	8YOS	STAY	1	2		2
1976	PIL	OTS	8YOS	STAY	2	2		25
1976	PIL	OTS	8YOS	LEAVE	1			23
1976	PIL	OTS	8YOS	LEAVE	1	1		1
1976	PIL	OTS	8YOS	LEAVE	2	2		2
1976	PIL	OTS	8YOS	LEAVE	2			8
1977	PIL	OTS	6YOS	STAY	1			4
1977	PIL	OTS	6YOS	STAY	2			2
1977	PIL	OTS	6YOS	LEAVE	1			10
1977	PIL	OTS	7YOS	STAY	1			456

1977	PIL	OTS	7YOS	STAY	2					360
1977	PIL	OTS	7YOS	LEAVE	1					441
1977	PIL	OTS	7YOS	LEAVE	2					36
1977	PIL	OTS	8YOS	STAY	1					82
1977	PIL	OTS	8YOS	STAY	2					52
1977	PIL	OTS	8YOS	LEAVE	1					60
1977	PIL	OTS	8YOS	LEAVE	2					9
1973	NAV	ACAD	6YOS	STAY	2					1
1973	NAV	ACAD	6YOS	STAY	2	2	2			2
1973	NAV	ACAD	6YOS	STAY	2	2	2	2	2	10
1973	NAV	ACAD	6YOS	LEAVE	2					4
1973	NAV	ACAD	6YOS	LEAVE	2	2				1
1973	NAV	ACAD	7YOS	STAY	2	2	2	2	2	16
1973	NAV	ACAD	7YOS	STAY	2					1
1973	NAV	ACAD	7YOS	STAY	2	2				2
1973	NAV	ACAD	7YOS	LEAVE	2					1
1973	NAV	ACAD	7YOS	LEAVE	2	2				3
1973	NAV	ACAD	7YOS	LEAVE	2	2	2			1
1973	NAV	ACAD	8YOS	STAY	2					1
1973	NAV	ACAD	8YOS	STAY	2	2	2	2	2	5
1974	NAV	ACAD	6YOS	STAY	2	2	2	2		15
1974	NAV	ACAD	6YOS	LEAVE	2					4
1974	NAV	ACAD	6YOS	LEAVE	2	2				1
1974	NAV	ACAD	6YOS	LEAVE	2	2	2	2		2
1974	NAV	ACAD	7YOS	STAY	2					1
1974	NAV	ACAD	7YOS	STAY	2	2				1
1974	NAV	ACAD	7YOS	STAY	2	2	2	2		12
1974	NAV	ACAD	7YOS	LEAVE	2					5
1974	NAV	ACAD	7YOS	LEAVE	2	2				1
1974	NAV	ACAD	7YOS	LEAVE	2	2	2			1
1974	NAV	ACAD	8YOS	STAY	2	2	2	2		1
1975	NAV	ACAD	7YOS	STAY	2	2				2
1975	NAV	ACAD	7YOS	STAY	2	2	2			7
1975	NAV	ACAD	7YOS	LEAVE	2					2
1975	NAV	ACAD	8YOS	STAY	2	2	2			4
1975	NAV	ACAD	8YOS	LEAVE	2	2				1
1976	NAV	ACAD	7YOS	STAY	2					2
1976	NAV	ACAD	7YOS	STAY	2	2				38
1976	NAV	ACAD	7YOS	LEAVE	2	2				5
1976	NAV	ACAD	7YOS	LEAVE	2					8
1976	NAV	ACAD	8YOS	STAY	2	2				2
1977	NAV	ACAD	7YOS	STAY	2					30
1977	NAV	ACAD	7YOS	LEAVE	2					2
1977	NAV	ACAD	8YOS	STAY	2					18
1977	NAV	ACAD	8YOS	LEAVE	2					3
1973	NAV	ROTC	6YOS	STAY	1	1	1	1	1	32
1973	NAV	ROTC	6YOS	STAY	1	1	1	1	2	8
1973	NAV	ROTC	6YOS	STAY	1	1	1	2	2	6
1973	NAV	ROTC	6YOS	STAY	1					3
1973	NAV	ROTC	6YOS	STAY	1	1				1
1973	NAV	ROTC	6YOS	STAY	2	2	2			1
1973	NAV	ROTC	6YOS	STAY	2	2	2	2	2	71
1973	NAV	ROTC	6YOS	STAY	2	2	2	2	13	1
1973	NAV	ROTC	6YOS	LEAVE	1					54
1973	NAV	ROTC	6YOS	LEAVE	1	1				12
1973	NAV	ROTC	6YOS	LEAVE	1	1	1			1
1973	NAV	ROTC	6YOS	LEAVE	1	1	1	1		1
1973	NAV	ROTC	6YOS	LEAVE	1	1	1	1	1	1
1973	NAV	ROTC	6YOS	LEAVE	2					24
1973	NAV	ROTC	6YOS	LEAVE	2	2				3
1973	NAV	ROTC	6YOS	LEAVE	2	2	2			1

1973	NAV	ROTC	6YOS	LEAVE	2	2	2	2	2	2
1973	NAV	ROTC	7YOS	STAY	1	1	1	1		3
1973	NAV	ROTC	7YOS	STAY	1	1	1	1	1	7
1973	NAV	ROTC	7YOS	STAY	1	1	2			1
1973	NAV	ROTC	7YOS	STAY	1	1				1
1973	NAV	ROTC	7YOS	STAY	2					1
1973	NAV	ROTC	7YOS	STAY	2	2	2			1
1973	NAV	ROTC	7YOS	STAY	2	2	2	2	2	45
1973	NAV	ROTC	7YOS	STAY	2	2	2	2	14	1
1973	NAV	ROTC	7YOS	LEAVE	1					8
1973	NAV	ROTC	7YOS	LEAVE	2					6
1973	NAV	ROTC	7YOS	LEAVE	2	2				3
1973	NAV	ROTC	7YOS	LEAVE	2	2	2			2
1973	NAV	ROTC	7YOS	LEAVE	2	2	2	2	2	2
1973	NAV	ROTC	8YOS	STAY	1	1				1
1973	NAV	ROTC	8YOS	STAY	1	1	1	1	1	2
1973	NAV	ROTC	8YOS	STAY	2	2	2	2	2	5
1973	NAV	ROTC	8YOS	STAY	2	2	2	2	15	9
1973	NAV	ROTC	8YOS	LEAVE	1	1				1
1973	NAV	ROTC	8YOS	LEAVE	2					1
1973	NAV	ROTC	8YOS	LEAVE	2	2				1
1974	NAV	ROTC	6YOS	STAY	1					1
1974	NAV	ROTC	6YOS	STAY	1	1				1
1974	NAV	ROTC	6YOS	STAY	1	1	1			1
1974	NAV	ROTC	6YOS	STAY	1	1	1	1		17
1974	NAV	ROTC	6YOS	STAY	1	1	1	2		21
1974	NAV	ROTC	6YOS	STAY	1	2	2			1
1974	NAV	ROTC	6YOS	STAY	1	2	2	2		2
1974	NAV	ROTC	6YOS	STAY	2					1
1974	NAV	ROTC	6YOS	STAY	2	2				3
1974	NAV	ROTC	6YOS	STAY	2	2	2			3
1974	NAV	ROTC	6YOS	STAY	2	2	2	2		58
1974	NAV	ROTC	6YOS	LEAVE	1					41
1974	NAV	ROTC	6YOS	LEAVE	1	1				2
1974	NAV	ROTC	6YOS	LEAVE	1	1	1			3
1974	NAV	ROTC	6YOS	LEAVE	1	1	1	1		2
1974	NAV	ROTC	6YOS	LEAVE	2					18
1974	NAV	ROTC	6YOS	LEAVE	2	2				4
1974	NAV	ROTC	6YOS	LEAVE	2	2	2			3
1974	NAV	ROTC	7YOS	STAY	1					4
1974	NAV	ROTC	7YOS	STAY	1	1	1	1		15
1974	NAV	ROTC	7YOS	STAY	1	1	1	2		7
1974	NAV	ROTC	7YOS	STAY	2	2	2	2		49
1974	NAV	ROTC	7YOS	STAY	2	2	2			1
1974	NAV	ROTC	7YOS	LEAVE	1					6
1974	NAV	ROTC	7YOS	LEAVE	1	1				2
1974	NAV	ROTC	7YOS	LEAVE	1	1	1			2
1974	NAV	ROTC	7YOS	LEAVE	2					4
1974	NAV	ROTC	7YOS	LEAVE	2	2				1
1974	NAV	ROTC	7YOS	LEAVE	2	2	2	2		2
1974	NAV	ROTC	8YOS	STAY	1	1	1			2
1974	NAV	ROTC	8YOS	STAY	2					1
1974	NAV	ROTC	8YOS	STAY	2	2	2			1
1974	NAV	ROTC	8YOS	STAY	2	2	2	2		7
1974	NAV	ROTC	8YOS	STAY	2	2	13	13		1
1974	NAV	ROTC	8YOS	LEAVE	1					1
1974	NAV	ROTC	8YOS	LEAVE	2					2
1975	NAV	ROTC	6YOS	STAY	1					1
1975	NAV	ROTC	6YOS	STAY	1	1				1
1975	NAV	ROTC	6YOS	STAY	1	1	1			16
1975	NAV	ROTC	6YOS	STAY	1	1	2			6

1975	NAV	ROTC	6YOS	STAY	1	2				1
1975	NAV	ROTC	6YOS	STAY	1	2	2			5
1975	NAV	ROTC	6YOS	STAY	2					2
1975	NAV	ROTC	6YOS	STAY	2	2	2			44
1975	NAV	ROTC	6YOS	LEAVE	1					45
1975	NAV	ROTC	6YOS	LEAVE	1	1				1
1975	NAV	ROTC	6YOS	LEAVE	1	1	1			2
1975	NAV	ROTC	6YOS	LEAVE	2					14
1975	NAV	ROTC	6YOS	LEAVE	2	2				1
1975	NAV	ROTC	7YOS	STAY	1					2
1975	NAV	ROTC	7YOS	STAY	1	1	1			14
1975	NAV	ROTC	7YOS	STAY	1	1	2			11
1975	NAV	ROTC	7YOS	STAY	1	1				1
1975	NAV	ROTC	7YOS	STAY	2	2	2			35
1975	NAV	ROTC	7YOS	LEAVE	1	1				1
1975	NAV	ROTC	7YOS	LEAVE	1					8
1975	NAV	ROTC	7YOS	LEAVE	2					2
1975	NAV	ROTC	8YOS	STAY	1	1	1			1
1975	NAV	ROTC	8YOS	STAY	2	2	2			5
1976	NAV	ROTC	6YOS	STAY	1	1				3
1976	NAV	ROTC	6YOS	STAY	1					1
1976	NAV	ROTC	6YOS	STAY	2	2				10
1976	NAV	ROTC	6YOS	LEAVE	1					10
1976	NAV	ROTC	6YOS	LEAVE	1	1				1
1976	NAV	ROTC	6YOS	LEAVE	2					1
1976	NAV	ROTC	7YOS	STAY	1	1				23
1976	NAV	ROTC	7YOS	STAY	1					2
1976	NAV	ROTC	7YOS	STAY	1	2				4
1976	NAV	ROTC	7YOS	STAY	2					1
1976	NAV	ROTC	7YOS	STAY	2	2				52
1976	NAV	ROTC	7YOS	LEAVE	1					18
1976	NAV	ROTC	7YOS	LEAVE	1	1				6
1976	NAV	ROTC	7YOS	LEAVE	2					3
1976	NAV	ROTC	7YOS	LEAVE	2	2				2
1976	NAV	ROTC	8YOS	STAY	1	1				2
1976	NAV	ROTC	8YOS	STAY	2					1
1976	NAV	ROTC	8YOS	STAY	2	2				9
1976	NAV	ROTC	8YOS	LEAVE	1					1
1976	NAV	ROTC	8YOS	LEAVE	2					1
1976	NAV	ROTC	8YOS	LEAVE	2	2				1
1977	NAV	ROTC	6YOS	STAY	1					11
1977	NAV	ROTC	6YOS	STAY	2					8
1977	NAV	ROTC	6YOS	LEAVE	1					14
1977	NAV	ROTC	6YOS	LEAVE	2					1
1977	NAV	ROTC	7YOS	STAY	1					72
1977	NAV	ROTC	7YOS	STAY	2					77
1977	NAV	ROTC	7YOS	LEAVE	1					52
1977	NAV	ROTC	7YOS	LEAVE	2					8
1977	NAV	ROTC	8YOS	STAY	1					14
1977	NAV	ROTC	8YOS	STAY	2					13
1977	NAV	ROTC	8YOS	LEAVE	1					8
1977	NAV	ROTC	8YOS	LEAVE	2					2
1973	NAV	OTS	6YOS	STAY	1					2
1973	NAV	OTS	6YOS	STAY	1	1				3
1973	NAV	OTS	6YOS	STAY	1	1	1			1
1973	NAV	OTS	6YOS	STAY	1	1	1	1		1
1973	NAV	OTS	6YOS	STAY	1	1	1	1	1	30
1973	NAV	OTS	6YOS	STAY	1	1	1	1	2	12
1973	NAV	OTS	6YOS	STAY	1	1	1	2	2	7
1973	NAV	OTS	6YOS	STAY	1	1	2	2	2	1
1973	NAV	OTS	6YOS	STAY	1	2	2	2	2	1

1973	NAV	OTS	6YOS	STAY	2	2	2			1
1973	NAV	OTS	6YOS	STAY	2	2	2	2		1
1973	NAV	OTS	6YOS	STAY	2	2	2	2	2	39
1973	NAV	OTS	6YOS	LEAVE	1	1				24
1973	NAV	OTS	6YOS	LEAVE	1	1	1	1		1
1973	NAV	OTS	6YOS	LEAVE	1	1	1	1	1	2
1973	NAV	OTS	6YOS	LEAVE	1					78
1973	NAV	OTS	6YOS	LEAVE	2					22
1973	NAV	OTS	6YOS	LEAVE	2	2				12
1973	NAV	OTS	6YOS	LEAVE	2	2	2			2
1973	NAV	OTS	6YOS	LEAVE	2	2	2	2		2
1973	NAV	OTS	6YOS	LEAVE	2	2	2	2	2	1
1973	NAV	OTS	7YOS	STAY	1					1
1973	NAV	OTS	7YOS	STAY	1	1				3
1973	NAV	OTS	7YOS	STAY	1	1	1	1		1
1973	NAV	OTS	7YOS	STAY	1	1	1	1	1	9
1973	NAV	OTS	7YOS	STAY	1	1	1	2	2	2
1973	NAV	OTS	7YOS	STAY	2					1
1973	NAV	OTS	7YOS	STAY	2	2				3
1973	NAV	OTS	7YOS	STAY	2	2	2	2	2	45
1973	NAV	OTS	7YOS	STAY	2	2	2	2	14	2
1973	NAV	OTS	7YOS	LEAVE	1					21
1973	NAV	OTS	7YOS	LEAVE	1	1				2
1973	NAV	OTS	7YOS	LEAVE	1	1	1	1	1	1
1973	NAV	OTS	7YOS	LEAVE	2					16
1973	NAV	OTS	7YOS	LEAVE	2	2				7
1973	NAV	OTS	7YOS	LEAVE	2	2	2	2		1
1973	NAV	OTS	8YOS	STAY	1	1	1	1		1
1973	NAV	OTS	8YOS	STAY	1	2	2	2	15	1
1973	NAV	OTS	8YOS	STAY	2					1
1973	NAV	OTS	8YOS	STAY	2	2	2	2	2	10
1973	NAV	OTS	8YOS	STAY	2	2	2	2	15	3
1973	NAV	OTS	8YOS	STAY	2	2	2	14	14	1
1973	NAV	OTS	8YOS	LEAVE	2					2
1973	NAV	OTS	8YOS	LEAVE	2	2	2	2	2	1
1974	NAV	OTS	6YOS	STAY	1	1				1
1974	NAV	OTS	6YOS	STAY	1	1	1	1		21
1974	NAV	OTS	6YOS	STAY	1	1	1	2		21
1974	NAV	OTS	6YOS	STAY	1	2	2			1
1974	NAV	OTS	6YOS	STAY	1	2	2	2		16
1974	NAV	OTS	6YOS	STAY	2	2				1
1974	NAV	OTS	6YOS	STAY	2	2	2	2		29
1974	NAV	OTS	6YOS	STAY	2	2	2	12		1
1974	NAV	OTS	6YOS	LEAVE	1					131
1974	NAV	OTS	6YOS	LEAVE	1	1				21
1974	NAV	OTS	6YOS	LEAVE	1	1	1			3
1974	NAV	OTS	6YOS	LEAVE	1	1	1	1		5
1974	NAV	OTS	6YOS	LEAVE	1	2	2	2		1
1974	NAV	OTS	6YOS	LEAVE	2					38
1974	NAV	OTS	6YOS	LEAVE	2	2				3
1974	NAV	OTS	6YOS	LEAVE	2	2	2			1
1974	NAV	OTS	6YOS	LEAVE	2	2	2	2		1
1974	NAV	OTS	7YOS	STAY	1	1	1	1		14
1974	NAV	OTS	7YOS	STAY	1	1	1	2		11
1974	NAV	OTS	7YOS	STAY	1	1	2	2		3
1974	NAV	OTS	7YOS	STAY	2	2				4
1974	NAV	OTS	7YOS	STAY	2	2	2	2		39
1974	NAV	OTS	7YOS	STAY	2	2	2	13		2
1974	NAV	OTS	7YOS	LEAVE	1					23
1974	NAV	OTS	7YOS	LEAVE	1	1				5
1974	NAV	OTS	7YOS	LEAVE	2	2				6

1974	NAV	OTS	7YOS	LEAVE	2	2	2	2	1
1974	NAV	OTS	7YOS	LEAVE	2				9
1974	NAV	OTS	8YOS	STAY	1	1	1	1	2
1974	NAV	OTS	8YOS	STAY	1	1	2	2	1
1974	NAV	OTS	8YOS	STAY	2				1
1974	NAV	OTS	8YOS	STAY	2	2	2	2	9
1974	NAV	OTS	8YOS	LEAVE	1				2
1974	NAV	OTS	8YOS	LEAVE	2				5
1975	NAV	OTS	6YOS	STAY	1				2
1975	NAV	OTS	6YOS	STAY	1	2	2		7
1975	NAV	OTS	6YOS	STAY	1	1	2		18
1975	NAV	OTS	6YOS	STAY	1	1			1
1975	NAV	OTS	6YOS	STAY	1	1	1		42
1975	NAV	OTS	6YOS	STAY	2	2	2		40
1975	NAV	OTS	6YOS	STAY	2	2			1
1975	NAV	OTS	6YOS	LEAVE	1				74
1975	NAV	OTS	6YOS	LEAVE	1	1			2
1975	NAV	OTS	6YOS	LEAVE	1	1	1		4
1975	NAV	OTS	6YOS	LEAVE	2				31
1975	NAV	OTS	6YOS	LEAVE	2	2	2		2
1975	NAV	OTS	6YOS	LEAVE	2	2			3
1975	NAV	OTS	7YOS	STAY	1				1
1975	NAV	OTS	7YOS	STAY	1	1	1		15
1975	NAV	OTS	7YOS	STAY	1	1	2		5
1975	NAV	OTS	7YOS	STAY	2	2			2
1975	NAV	OTS	7YOS	STAY	2	2	2		59
1975	NAV	OTS	7YOS	LEAVE	1				18
1975	NAV	OTS	7YOS	LEAVE	1	1	1		2
1975	NAV	OTS	7YOS	LEAVE	1	1			1
1975	NAV	OTS	7YOS	LEAVE	2	2	2		1
1975	NAV	OTS	7YOS	LEAVE	2				9
1975	NAV	OTS	8YOS	STAY	1	1	1		1
1975	NAV	OTS	8YOS	STAY	2	2	2		7
1975	NAV	OTS	8YOS	STAY	2				1
1975	NAV	OTS	8YOS	LEAVE	2	2			1
1976	NAV	OTS	6YOS	STAY	1	1			10
1976	NAV	OTS	6YOS	STAY	2	2			5
1976	NAV	OTS	6YOS	LEAVE	1	1			2
1976	NAV	OTS	6YOS	LEAVE	1				18
1976	NAV	OTS	6YOS	LEAVE	2				6
1976	NAV	OTS	7YOS	STAY	1	2			7
1976	NAV	OTS	7YOS	STAY	1	1			39
1976	NAV	OTS	7YOS	STAY	2				3
1976	NAV	OTS	7YOS	STAY	2	2			93
1976	NAV	OTS	7YOS	LEAVE	1				63
1976	NAV	OTS	7YOS	LEAVE	1	1			6
1976	NAV	OTS	7YOS	LEAVE	2				22
1976	NAV	OTS	7YOS	LEAVE	2	2			2
1976	NAV	OTS	8YOS	STAY	1	1			5
1976	NAV	OTS	8YOS	STAY	1	2			2
1976	NAV	OTS	8YOS	STAY	2				1
1976	NAV	OTS	8YOS	STAY	2	2			5
1976	NAV	OTS	8YOS	LEAVE	1				2
1976	NAV	OTS	8YOS	LEAVE	2				2
1977	NAV	OTS	6YOS	STAY	1				23
1977	NAV	OTS	6YOS	STAY	2				8
1977	NAV	OTS	6YOS	LEAVE	1				35
1977	NAV	OTS	6YOS	LEAVE	2				1
1977	NAV	OTS	7YOS	STAY	1				217
1977	NAV	OTS	7YOS	STAY	2				199
1977	NAV	OTS	7YOS	LEAVE	1				198

1977	NAV	OTS	7YOS	LEAVE	2					30
1977	NAV	OTS	8YOS	STAY	1					31
1977	NAV	OTS	8YOS	STAY	2					26
1977	NAV	OTS	8YOS	LEAVE	1					13
1977	NAV	OTS	8YOS	LEAVE	2					2
1973	NR	ACAD	6YOS	STAY	2	2	2	2	2	80
1973	NR	ACAD	6YOS	STAY	2	1	1	1	1	11
1973	NR	ACAD	6YOS	STAY	2					3
1973	NR	ACAD	6YOS	STAY	2	2				1
1973	NR	ACAD	6YOS	STAY	2	2	2	2	13	4
1973	NR	ACAD	6YOS	STAY	2	2	2			12
1973	NR	ACAD	6YOS	STAY	2	2	2	12	12	1
1973	NR	ACAD	6YOS	STAY	2	1	1			1
1973	NR	ACAD	6YOS	LEAVE	1					1
1973	NR	ACAD	6YOS	LEAVE	2					38
1973	NR	ACAD	6YOS	LEAVE	2	2				24
1973	NR	ACAD	6YOS	LEAVE	2	2	2			6
1973	NR	ACAD	6YOS	LEAVE	2	2	2	2		3
1973	NR	ACAD	6YOS	LEAVE	2	2	2	2	2	6
1973	NR	ACAD	7YOS	STAY	2	2	2	2	2	5
1973	NR	ACAD	7YOS	LEAVE	2	2				2
1974	NR	ACAD	6YOS	STAY	2					3
1974	NR	ACAD	6YOS	STAY	2	2				1
1974	NR	ACAD	6YOS	STAY	2	2	2			9
1974	NR	ACAD	6YOS	STAY	2	2	2	2		87
1974	NR	ACAD	6YOS	STAY	2	2	2	12		5
1974	NR	ACAD	6YOS	STAY	2	2	11	11		2
1974	NR	ACAD	6YOS	STAY	2	1	1	1		2
1974	NR	ACAD	6YOS	LEAVE	2					36
1974	NR	ACAD	6YOS	LEAVE	2	2				13
1974	NR	ACAD	6YOS	LEAVE	2	2	2			11
1974	NR	ACAD	6YOS	LEAVE	2	2	2	2		11
1975	NR	ACAD	6YOS	STAY	2	2	2			125
1975	NR	ACAD	6YOS	STAY	2					6
1975	NR	ACAD	6YOS	STAY	2	2				1
1975	NR	ACAD	6YOS	STAY	2	1	1			1
1975	NR	ACAD	6YOS	STAY	2	2	11			17
1975	NR	ACAD	6YOS	LEAVE	2	2				23
1975	NR	ACAD	6YOS	LEAVE	2	2	2			14
1975	NR	ACAD	6YOS	LEAVE	2					37
1976	NR	ACAD	6YOS	STAY	2					8
1976	NR	ACAD	6YOS	STAY	2	2				150
1976	NR	ACAD	6YOS	LEAVE	2	2				30
1976	NR	ACAD	6YOS	LEAVE	2					28
1977	NR	ACAD	6YOS	STAY	2					212
1977	NR	ACAD	6YOS	LEAVE	2					32
1973	NR	ROTC	5YOS	STAY	1					33
1973	NR	ROTC	5YOS	STAY	1	1				18
1973	NR	ROTC	5YOS	STAY	1	1	1			3
1973	NR	ROTC	5YOS	STAY	1	1	1	1		5
1973	NR	ROTC	5YOS	STAY	1	1	1	1	1	406
1973	NR	ROTC	5YOS	STAY	1	1	1	1	2	22
1973	NR	ROTC	5YOS	STAY	1	1	1	1	4	1
1973	NR	ROTC	5YOS	STAY	1	1	1	3	3	2
1973	NR	ROTC	5YOS	STAY	1	1	2	2	2	13
1973	NR	ROTC	5YOS	STAY	1	1	2	11	11	1
1973	NR	ROTC	5YOS	STAY	1	2	2	2	2	17
1973	NR	ROTC	5YOS	STAY	1	2	2	2	12	1
1973	NR	ROTC	5YOS	STAY	2	2	2	2	2	7
1973	NR	ROTC	5YOS	LEAVE	1	1	1			45
1973	NR	ROTC	5YOS	LEAVE	1	1	1	1		31

1973	NR	ROTC	5YOS	LEAVE	1	1	1	1	1	31
1973	NR	ROTC	5YOS	LEAVE	1	1	2	2	2	2
1973	NR	ROTC	5YOS	LEAVE	1	2	2	2	2	3
1973	NR	ROTC	5YOS	LEAVE	1					855
1973	NR	ROTC	5YOS	LEAVE	1	1				117
1973	NR	ROTC	5YOS	LEAVE	2					14
1973	NR	ROTC	5YOS	LEAVE	2	2				6
1973	NR	ROTC	6YOS	STAY	2					1
1973	NR	ROTC	6YOS	STAY	2	2				1
1973	NR	ROTC	6YOS	STAY	2	2	2			6
1973	NR	ROTC	6YOS	STAY	2	2	2	2		2
1973	NR	ROTC	6YOS	STAY	2	2	2	2	2	258
1973	NR	ROTC	6YOS	STAY	2	2	2	2	13	5
1973	NR	ROTC	6YOS	STAY	2	2	2	12	12	2
1973	NR	ROTC	6YOS	STAY	2	2	11	11	11	2
1973	NR	ROTC	6YOS	LEAVE	2					24
1973	NR	ROTC	6YOS	LEAVE	2	2				18
1973	NR	ROTC	6YOS	LEAVE	2	2	2			8
1973	NR	ROTC	6YOS	LEAVE	2	2	2	2		7
1973	NR	ROTC	6YOS	LEAVE	2	2	2	2	2	2
1973	NR	ROTC	7YOS	STAY	2	2				1
1973	NR	ROTC	7YOS	STAY	2	2	2			1
1973	NR	ROTC	7YOS	STAY	2	2	2	2	2	25
1973	NR	ROTC	7YOS	STAY	2	2	2	2	14	3
1973	NR	ROTC	7YOS	LEAVE	2					1
1973	NR	ROTC	7YOS	LEAVE	2	2				1
1974	NR	ROTC	5YOS	STAY	1					24
1974	NR	ROTC	5YOS	STAY	1	1				4
1974	NR	ROTC	5YOS	STAY	1	1	1			3
1974	NR	ROTC	5YOS	STAY	1	1	1	1		428
1974	NR	ROTC	5YOS	STAY	1	1	1	2		18
1974	NR	ROTC	5YOS	STAY	1	1	1	3		4
1974	NR	ROTC	5YOS	STAY	1	1	2	2		21
1974	NR	ROTC	5YOS	STAY	1	1	1	1		4
1974	NR	ROTC	5YOS	STAY	1	2	2	2		27
1974	NR	ROTC	5YOS	STAY	2	2				1
1974	NR	ROTC	5YOS	STAY	2	2	2	2		7
1974	NR	ROTC	5YOS	LEAVE	1					1051
1974	NR	ROTC	5YOS	LEAVE	1	1				123
1974	NR	ROTC	5YOS	LEAVE	1	1	1			37
1974	NR	ROTC	5YOS	LEAVE	1	1	1	1		36
1974	NR	ROTC	5YOS	LEAVE	1	2	2			1
1974	NR	ROTC	5YOS	LEAVE	1	2	2	2		2
1974	NR	ROTC	5YOS	LEAVE	2	2	2			5
1974	NR	ROTC	5YOS	LEAVE	2	2	2	2		4
1974	NR	ROTC	5YOS	LEAVE	2					49
1974	NR	ROTC	5YOS	LEAVE	2	2				11
1974	NR	ROTC	6YOS	STAY	2					2
1974	NR	ROTC	6YOS	STAY	2	2				9
1974	NR	ROTC	6YOS	STAY	2	2	2			7
1974	NR	ROTC	6YOS	STAY	2	2	2	2		333
1974	NR	ROTC	6YOS	STAY	2	2	2	12		9
1974	NR	ROTC	6YOS	STAY	2	1	1	1		1
1974	NR	ROTC	6YOS	STAY	2	2	11	11		1
1974	NR	ROTC	6YOS	LEAVE	2					50
1974	NR	ROTC	6YOS	LEAVE	2	2				17
1974	NR	ROTC	6YOS	LEAVE	2	2	2	2		11
1974	NR	ROTC	6YOS	LEAVE	2	2	2			12
1974	NR	ROTC	7YOS	STAY	2	2				2
1974	NR	ROTC	7YOS	STAY	2	2	2	2		26
1974	NR	ROTC	7YOS	STAY	2	2	2	13		1

1974	NR	ROTC	7YOS	LEAVE	2					3
1975	NR	ROTC	5YOS	STAY	1					8
1975	NR	ROTC	5YOS	STAY	1	2				1
1975	NR	ROTC	5YOS	STAY	1	1				1
1975	NR	ROTC	5YOS	STAY	1	1	2			42
1975	NR	ROTC	5YOS	STAY	1	2	2			39
1975	NR	ROTC	5YOS	STAY	1	1	1			380
1975	NR	ROTC	5YOS	STAY	2	2	2			7
1975	NR	ROTC	5YOS	STAY	2					1
1975	NR	ROTC	5YOS	LEAVE	1	1	1			55
1975	NR	ROTC	5YOS	LEAVE	1	1				70
1975	NR	ROTC	5YOS	LEAVE	1					1048
1975	NR	ROTC	5YOS	LEAVE	2					40
1975	NR	ROTC	5YOS	LEAVE	2	2	2			3
1975	NR	ROTC	5YOS	LEAVE	2	2				8
1975	NR	ROTC	6YOS	STAY	2					2
1975	NR	ROTC	6YOS	STAY	2	2				12
1975	NR	ROTC	6YOS	STAY	2	2	2			383
1975	NR	ROTC	6YOS	LEAVE	2					58
1975	NR	ROTC	6YOS	LEAVE	2	2				15
1975	NR	ROTC	6YOS	LEAVE	2	2	2			13
1976	NR	ROTC	5YOS	STAY	1	1				493
1976	NR	ROTC	5YOS	STAY	1	2				129
1976	NR	ROTC	5YOS	STAY	1					8
1976	NR	ROTC	5YOS	STAY	2	2				1
1976	NR	ROTC	5YOS	LEAVE	1	1				87
1976	NR	ROTC	5YOS	LEAVE	1					1090
1976	NR	ROTC	5YOS	LEAVE	2					55
1976	NR	ROTC	5YOS	LEAVE	2	2				8
1976	NR	ROTC	6YOS	STAY	2					2
1976	NR	ROTC	6YOS	STAY	2	2				289
1976	NR	ROTC	6YOS	LEAVE	2	2				15
1976	NR	ROTC	6YOS	LEAVE	2					33
1977	NR	ROTC	5YOS	STAY	1					806
1977	NR	ROTC	5YOS	STAY	2					4
1977	NR	ROTC	5YOS	LEAVE	1					766
1977	NR	ROTC	5YOS	LEAVE	2					34
1977	NR	ROTC	6YOS	STAY	2					231
1977	NR	ROTC	6YOS	LEAVE	2					26
1973	NR	OTS	5YOS	STAY	1	1	1	3	11	1
1973	NR	OTS	5YOS	STAY	1	1	2	2	2	13
1973	NR	OTS	5YOS	STAY	1	1	2	1	1	1
1973	NR	OTS	5YOS	STAY	1	2	2	2	2	8
1973	NR	OTS	5YOS	STAY	1					30
1973	NR	OTS	5YOS	STAY	1	1				16
1973	NR	OTS	5YOS	STAY	1	1	1			2
1973	NR	OTS	5YOS	STAY	1	1	1	1	1	217
1973	NR	OTS	5YOS	STAY	1	1	1	1	2	8
1973	NR	OTS	5YOS	STAY	1	1	1	3	3	1
1973	NR	OTS	5YOS	STAY	2					2
1973	NR	OTS	5YOS	STAY	2	2	2	2	2	3
1973	NR	OTS	5YOS	LEAVE	1					821
1973	NR	OTS	5YOS	LEAVE	1	1				124
1973	NR	OTS	5YOS	LEAVE	1	1	1			34
1973	NR	OTS	5YOS	LEAVE	1	1	1	1		16
1973	NR	OTS	5YOS	LEAVE	1	1	1	1	1	15
1973	NR	OTS	5YOS	LEAVE	1	1	2	2		2
1973	NR	OTS	5YOS	LEAVE	1	2	2	2	2	1
1973	NR	OTS	5YOS	LEAVE	2					52
1973	NR	OTS	5YOS	LEAVE	2	2				18
1973	NR	OTS	5YOS	LEAVE	2	2	2			1

1973	NR	OTS	5YOS	LEAVE	2	2	2	2		3
1973	NR	OTS	6YOS	STAY	2	2				2
1973	NR	OTS	6YOS	STAY	2	2	2			6
1973	NR	OTS	6YOS	STAY	2	2	2	2		1
1973	NR	OTS	6YOS	STAY	2	2	2	2	2	218
1973	NR	OTS	6YOS	STAY	2	2	2	2	13	2
1973	NR	OTS	6YOS	STAY	2	2	2	12	12	3
1973	NR	OTS	6YOS	LEAVE	2					35
1973	NR	OTS	6YOS	LEAVE	2	2				14
1973	NR	OTS	6YOS	LEAVE	2	2	2			6
1973	NR	OTS	6YOS	LEAVE	2	2	2	2		6
1973	NR	OTS	6YOS	LEAVE	2	2	2	2	2	9
1973	NR	OTS	7YOS	STAY	2	2	2	2	2	38
1973	NR	OTS	7YOS	STAY	2	2	2	2	14	1
1973	NR	OTS	7YOS	STAY	2	2	2	13	13	1
1973	NR	OTS	7YOS	LEAVE	2					2
1973	NR	OTS	7YOS	LEAVE	2	2	2	2		1
1973	NR	OTS	7YOS	LEAVE	2	2	2	2	2	2
1974	NR	OTS	5YOS	STAY	1					22
1974	NR	OTS	5YOS	STAY	1	1				2
1974	NR	OTS	5YOS	STAY	1	1	1			2
1974	NR	OTS	5YOS	STAY	1	1	1	1		279
1974	NR	OTS	5YOS	STAY	1	1	1	2		9
1974	NR	OTS	5YOS	STAY	1	1	1	3		2
1974	NR	OTS	5YOS	STAY	1	1	1	1		1
1974	NR	OTS	5YOS	STAY	1	2	2	2		22
1974	NR	OTS	5YOS	STAY	1	1	2	2		10
1974	NR	OTS	5YOS	STAY	2					1
1974	NR	OTS	5YOS	STAY	2	2	2	2		10
1974	NR	OTS	5YOS	LEAVE	1					905
1974	NR	OTS	5YOS	LEAVE	1	1				99
1974	NR	OTS	5YOS	LEAVE	1	1	1			30
1974	NR	OTS	5YOS	LEAVE	1	1	1	1		24
1974	NR	OTS	5YOS	LEAVE	2					67
1974	NR	OTS	5YOS	LEAVE	2	2				6
1974	NR	OTS	5YOS	LEAVE	2	2	2			2
1974	NR	OTS	5YOS	LEAVE	2	2	2	2		2
1974	NR	OTS	6YOS	STAY	2					2
1974	NR	OTS	6YOS	STAY	2	2				2
1974	NR	OTS	6YOS	STAY	2	2	2			4
1974	NR	OTS	6YOS	STAY	2	2	2	12		2
1974	NR	OTS	6YOS	STAY	2	2	2	2		159
1974	NR	OTS	6YOS	LEAVE	2					20
1974	NR	OTS	6YOS	LEAVE	2	2				13
1974	NR	OTS	6YOS	LEAVE	2	2	2	2		5
1974	NR	OTS	6YOS	LEAVE	2	2	2			9
1974	NR	OTS	7YOS	STAY	2					1
1974	NR	OTS	7YOS	STAY	2	2	2	2		24
1975	NR	OTS	5YOS	STAY	1	1	1			152
1975	NR	OTS	5YOS	STAY	1	1	2			24
1975	NR	OTS	5YOS	STAY	1					9
1975	NR	OTS	5YOS	STAY	1	2	2			14
1975	NR	OTS	5YOS	STAY	2	2	2			1
1975	NR	OTS	5YOS	STAY	2					1
1975	NR	OTS	5YOS	LEAVE	1	1				34
1975	NR	OTS	5YOS	LEAVE	1	1	1			26
1975	NR	OTS	5YOS	LEAVE	1					428
1975	NR	OTS	5YOS	LEAVE	2					10
1975	NR	OTS	5YOS	LEAVE	2	2				1
1975	NR	OTS	6YOS	STAY	2	2				5
1975	NR	OTS	6YOS	STAY	2	2	11			1

1975	NR	OTS	6YOS	STAY	2	2	2	131
1975	NR	OTS	6YOS	STAY	2			1
1975	NR	OTS	6YOS	LEAVE	2			25
1975	NR	OTS	6YOS	LEAVE	2	2	2	7
1975	NR	OTS	6YOS	LEAVE	2	2		9
1976	NR	OTS	5YOS	STAY	1			8
1976	NR	OTS	5YOS	STAY	1	1		171
1976	NR	OTS	5YOS	STAY	1	2		27
1976	NR	OTS	5YOS	LEAVE	1			280
1976	NR	OTS	5YOS	LEAVE	1	1		25
1976	NR	OTS	5YOS	LEAVE	2			4
1976	NR	OTS	6YOS	STAY	2	2		38
1976	NR	OTS	6YOS	LEAVE	2	2		4
1976	NR	OTS	6YOS	LEAVE	2			5
1977	NR	OTS	5YOS	STAY	1			112
1977	NR	OTS	5YOS	LEAVE	1			89
1977	NR	OTS	5YOS	LEAVE	2			2
1977	NR	OTS	6YOS	STAY	2			20
1977	NR	OTS	6YOS	LEAVE	2			5

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